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ANNALS of the Association of American Geographers

VOLUME XIX

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No 1

THE MISSISSIPPI PROBLEM

A CONFLICT IN ECONOMIC EMPHASIS

W. H. HAAS

Two great problems in the Mississippi Valley are awaiting solution. Both have been more or less urgent during the entire period of mid-west development; but, in recent years, due to the ever growing press of population and production they have become increasingly serious. Both have had attention by state and national governments with fairly liberal appropriations for improving conditions; yet, it is not a misrepresentation to say that neither is any nearer an ultimate solution than it was half a century ago. What is perhaps the more serious phase still, is that the methods thus far employed in an attempted amelioration of the conditions of the one have, in the main, had a tendency to intensify the seriousness of the situation in the other. Thus out of the two has arisen a third, a greater, more comprehensive one which asks: Is it possible to solve both problems, even though their interests overlap and are antagonistic in part, by a common formula or plan? Manifestly, unless such a common plan can be evolved, there can be no solution satisfactory to both, since the interests of the one or of the other naturally must take precedence in any other kind of procedure.

The older of these problems, and none the less vital because the less spectacular, has been the seeking by the mid-west of a water outlet to the sea. The Mississippi because of its great size might well be expected to afford such a channel, but it does not in spite of the millions expended on it, nominally at least to this end. The results thus far obtained do not make a healthy showing. Perhaps the development of the Mississippi into a route to the sea is economically not feasible and our army engineers have been asked

for a permanent improvement of the Mississippi as a navigable channel. The added charge was to safeguard life upon the stream, and, as an afterthought, also on land from flood waters. Evidently this charge a little later seemed too inclusive, for with the first appropriation in 1881 the bill specifically stated that

"No portion of the sum hereby appropriated shall be used for repair or construction of levees for the purpose of preventing injury to lands by overflow or for any other purpose whatsoever, except as a means of deepening or improving the channel of the river."⁴

Avowedly this has been the guiding principle to this day, but actually it has not been adhered to for the simple reason that it has not been possible to tell where navigation control ends and floods control begins. Out of this, however, has grown the famous, but now obsolete policy of "levees only" system of flood control.

Under this system no unified control has been possible, in fact, is not permitted. The army engineer, true to his charge, bent his energy to the making of the channel navigable, avoiding, if possible, a greater flood hazard, but making navigability the direct object of his concern. In what degree he has succeeded in this is a matter of record. To what extent through the building of levees he has helped to solve the flood problem is also a matter of record. On the other hand, to what extent some of his works have added to the seriousness of the flood hazard is not so easily determined. Nevertheless, to the student of running water it is quite evident that there has been a slowing up and a consequent piling up of waters, increasing the flood hazard.

The question may well be asked what is the present outlook for a complete solution of these problems? To answer that one must keep in mind that the solution must satisfy two jealous masters—transportation as well as flood control—with diverse and overlapping interests. The one has been studied by army engineers for half a century, the other has just been taken under the protective wing of the United States Army. The one is concerned chiefly with low, the other with high waters. The one makes use of the river 365 days in the year, dangerously high waters come about every fifth year and last, at most, only a few days or weeks. The one has the backing of almost all the people of the mid-west because of the almost universal conviction that a real outlet to the sea would materially lower freight rates, the other has the half-hearted support of the people at large and the vital interest only

⁴Quoted in *World's Work*, Vol. XXX (1915), p. 236.

of the suffering few, relatively a very small group occupying a very small land area. As a result the interests of the one are kept and played up before the public and our lawmakers, while the interests of the other are heard only intermittently. That under present conditions a comprehensive and unified policy is to be developed and carried out scientifically according to the tenets of the several sciences involved is almost beyond our fondest dreams. Such a policy, as a matter of fact, cannot be carried out at once, for the simple reason that not sufficient basic data are available to make such a plan.

One of the sad commentaries on our national life is the small part scientific men have been asked to take in solving truly scientific problems of national importance. Great Britain, annually, has been appropriating a half million dollars for a study alone of the waters of the Nile,⁵ and has built up sufficient fundamental data to which with justice she applies the phrase, water science of the Nile. Much of the data available on the Mississippi in comparison appears crude and woefully out of date. However, the recent appointment of a member of the United States Geological Survey to make a study of the river is encouraging.⁶

Up to the present no one has made any study, worthy the name, covering the hydrology of the Mississippi. Unquestionably no individual has undertaken this work, not only because of the great intricacy of the problem, but more because of the great expense involved in collecting the quantitative data necessary to draw even the simpler conclusions. In a recent study, in part on the tidal section of the Mississippi, Campbell⁷ comes to the conclusion that to answer certain questions "involves a careful analysis of the mechanics of stream flow under diverse conditions, and consequently is highly complicated and involved." He does not attempt to make an analysis. That no one has attempted to make such an analysis seems all the more strange since here is our greatest of rivers flowing at or near zero gradient and yet carrying such a tremendous burden of silt. Such a study, however, cannot emanate from some philosopher's chair but must come from the observation

⁵Hurst, H. E., Progress in the Study of the Hydrology of the Nile in the Last Twenty Years. *Geogr. Jour.* LXX (1927), 440-464.

⁶"Mr. F. E. Matthes of the U. S. Geol. Surv. is to undertake a study of the geologic history of the Mississippi River and its tributaries with particular regard to the problem of flood control." *Eng. and Min. Jour.*, Oct. 6, 1928, p. 553.

⁷Campbell, Marius R.: Meaning of Meanders in Tidal Streams, *Bull. Geol. Soc. of Am.*, XXXVIII (1927), pp. 537-556.

of field and laboratory conditions and consequently involves an expense too heavy for the individual to carry.

The basic conditions of the real problem of the Mississippi lie below Cairo where the river has a wide flood plain, more or less protected by a series of levees. Here the river flows in varying volume and varying gradients over a bed of shifting alluvium. At its maximum the river may carry as much as thirty times as much water as at its minimum.⁸ The altitude range between high and low water has been as much as 55.69 feet at Cairo, and 55.90 feet at the mouth of the Red River. If the levees had been built sufficiently high to hold the highest flood stage the range would naturally have been much higher still.

This section with a length of 1060 miles is more than double what it would be were there no meanders. The surface gradient of the water at its highest stage is 3.63 inches per mile, the grade for the lowest stage is 3.00 inches per mile. If the river is neither aggrading nor degrading its channel with these gradients, as is claimed by army engineers, then it would be a relatively simple process to cause the river bed to aggrade or degrade to any degree that would seem advisable. To lengthen the stream course, either by elongating the passes as has been done, or enlarging meanders as also has occurred with cause aggradation of the entire stream course at grade above the point. To shorten the stream by cutting off meanders or otherwise reducing its length will cause, other things being equal, a degradation from that point upward. At the Natches Bend the river travels at least ten miles to go one. With a present gradient of three inches per mile, a cut-off would give the mile a new gradient of thirty inches. Manifestly, if a cut-off were permitted, the alluvial base would cut down quickly until the same gradient of three inches per mile at and above this point were again established.

What the extended effect of such deliberate manipulations would be cannot be told as no quantitative data are available. The problem is not as simple, however, as it seems, but extremely complicated as already stated, even in so relatively simple matter as gradient. It may not be generally appreciated that the lowest low-water gradient of the Mississippi at mean tide, between New Orleans (Carrolton) and the head of the passes is less than zero (-0.186 inches per mile). This means that the water level actu-

⁸*Ann. Rept. Chief of Engineers, U. S. Army (1927), p. 1805.*

ally is below mean sea-level at certain periods (-1.73 feet) one hundred miles or more from the gulf. Even at flood time the gradient here is rarely above two inches per mile. How the enormous burden of silt is carried out over this extremely low gradient has never been satisfactorily explained. In contrast the gradient of the lower Missouri, also at grade, is extremely high by comparison. The extreme low water gradient of this stream for similar distances is more than ten times that of the Mississippi and strange as it may seem the low water gradient (12.24 inches per mile) is greater than the high water gradient (10.50).

The balance between aggradation and degradation is so delicate that the least modification of the channel will have its effect one way or the other. If degradation were started, its effects might be rather serious as undercutting unquestionably also would start and with the increased caving of the banks the added sediment might become a very serious menace to keeping the channel open for navigation. On the other hand unquestionably much of what the engineer has done to make the stream more navigable has helped in aggrading the channel somewhat and thus increased the flood hazard tremendously. It is easy, however, to criticise what has or has not been done, and relatively easy also to say what, on the face of it, seemingly should be done; but no one at the present time is able to lay down plans for a comprehensive program, for no one knows what the ultimate effects of this or that program will be. What is more, with the diverse and overlapping interests involved and with the utter lack of data upon which judgment might be based, the problem of problems may again be stated: Is the unification of all interests possible, so that one unbiased, comprehensive program can be planned and carried out?



FIGURE 1. Topographic map of Kern River Canyon and vicinity. The fault can be traced easily near Kern River but not at all across the upland to the southeast. Slightly enlarged from original. U.S.G.S.

THE KERN RIVER SCARP

ELIOT BLACKWELDER

Kern River is the southernmost of the rivers that drain the western slope of the Sierra Nevada, in California. It winds through the mountains in a canyon 1000 to 4000 feet deep. The lower part of this canyon, cut in massive granite, is particularly narrow. About sixteen miles east-northeast of Bakersfield, California, the river emerges from the mountainous plateau and flows out through the foothills. There it has cut a much wider, flat-bottomed valley with moderate slopes. The contrast is rather striking. At the lower end of its canyon, the river issues abruptly from a V-shaped notch in a straight rock wall. This slope, which is some 1300 feet high, has a declivity of about 35 to 38 degrees, and strikes North 50 degrees West. The origin of the wall is the subject of this paper.

The scarp and the plateau to the east of it consists of massive granite rock, intersected by several rather widely spaced systems of joints. Southwest of the wall, the lower hills are composed of Miocene sedimentary deposits,—chiefly soft sandy shale, sandstone, tuff,



FIGURE 2. The scarp and the notch cut in it by Kern River, as seen from the west. The relief of the scarp diminishes rapidly to the right.

and conglomerate, that are practically unconsolidated. It was long ago demonstrated by ordinary geologic mapping that the contact between these two formations is a steeply inclined fault of large displacement.

In view of the presence of the fault, the linear base of the scarp, the triangular facets, the hanging ravines, and the imposing abruptness of the wall itself, the feature has been rather generally diagnosed as a fault scarp. The eminent physiographer G. K. Gilbert¹ adopted this opinion, after making a casual visit to the locality in the later years of his life.

At this juncture it is necessary to make sure that there is no misunderstanding of the problem and its terms. What is a fault scarp? Geologists today are not all agreed in their usage of that term. By some, it is applied to any abrupt mountain front which has a fault along its base. At the other extreme there are a few who would apply the term only to that part of the fault plane (or fault surface) that has been exposed by very recent dislocation. Such features as the latter are very rare, because erosion quickly dissects and soon obliterates the actual fault surface. The majority of American physiographers, however, mean by the term "fault scarp" a steep slope—often of mountainous height—the relief of which is due to faulting, although erosion has modified its form considerably. They would distinguish some fault scarps as "initial," others as "young" or "slightly eroded," and the majority as "maturely eroded." As the dissection of the uplifted block proceeds further in the erosion cycle, the term "scarp" gradually becomes inapplicable, because slopes have been rather generally subdued and a "scarp" is a bold, abrupt front, whatever its origin. One may, however, recognize "subdued" fault-block mountains and "old" fault-block mountains, in which the original scarp has been destroyed.

Most modern physiographers now also distinguish clearly from true fault scarps those other abrupt slopes which have been made entirely by erosion upon bodies of resistant rock, separated by ancient faults from adjacent bodies of weak rocks. Such posthumous features are best called "fault-line scarps," as advocated by W. M.

¹Gilbert, G. K., *Studies of Basin Range Structure*. U. S. Geo. Surv. Prof. Paper 153, 1928, p. 86.



FIGURE 3. The Kern River scarp northwest of the canyon, as seen from the south. Triangular facets and linear base are shown.

Davis, although other terms, such as "erosion fault scarps," had been suggested earlier.²

The true fault scarp then is due directly to the dislocating of the earth's surface. It represents a new cycle of erosion and, although it may be somewhat dissected, that dissection only modifies its essentially tectonic form. On the other hand, the fault-line scarp has lost all of its tectonic topography. It is due exclusively to erosion, and its position coincides with the contact between hard and soft rocks, which in that case happens to be a fault. Such features develop rather late in the erosion cycle, and may be several cycles removed from the period of faulting which determined the subjacent rock structure. Thus it happens that true fault scarps are found only in regions of recent diastrophic activity, such as California; whereas fault-line scarps are common in regions where such activity subdivided several geologic periods ago, as in New England and Texas.

Returning to the subject of the Kern River front, we may now ask whether it is a true fault scarp or a fault-line scarp. There

²J. E. Spurr, Origin and Structure of the Basin Ranges, *Bull. G.S.A.*, Vol. 12, 1901, pp. 217-270.

are various criteria for distinguishing the two, but they have not yet been fully elaborated; and there is still a good deal of disagreement among physiographers regarding them.³

Most of the distinguishing features of fault scarps are rather special, being found in one case but not in another. Thus along some of the young fault scarps in California coast ranges there are wedge-shaped hills, sinks, ponds, and other anomalous features commonly known as "rift features." In another case a thick deposit of alluvium on the downthrown block may give evidence of recent dislocation of stream profiles.

In my opinion, the best generally available criterion for a young fault scarp is lack of correlation between rock hardness and topographic form. For example, there are places in the California coast ranges southeast of Monterey Bay where unconsolidated Pliocene sedimentary deposits stand out in bold scarps almost as high as others composed of Mesozoic sandstone and even granite or rhyolite. Had there been any great lapse of time since the faulting, the weak Pliocene deposits would have been worn down to lowlands, leaving only the more resistant rocks to form hills and mountains. Of course the value of this criterion decreases with the progress of the erosion cycle; but that is also true of most of the other evidence for fault scarps.

On the other hand, the fault-line scarp shows close agreement between topographic forms and the hardness of the rock masses of the substructure. So faithfully does this relation hold, that the scarp may be reversed, forming on the downthrown block and facing the degraded upthrown side.

Another common fact peculiar to fault-line scarps is that the trace of the fault is often not limited to the base of the scarp, but runs up into the lower spurs and foothills, crossing them without topographic effect. In such cases the relief of the scarp varies erratically from ridge crest to valley bottom all along the front of the highland.

There are many features of fault scarps that may be developed just as well on fault-line scarps and therefore are not valuable indicators of either. Among these are triangular facets on the spurs, alignment of spur-ends, truncation of structures by the scarp base, abruptness of the scarp, hot springs, breccias, slickensides, asymmetry of the range, and the ungraded and even hanging con-

³For a recent discussion of these criteria see the writer's paper on "The Recognition of Fault Scarps," *Journal of Geology*, Vol. XXXVI, 1928, pp. 289-311

dition of ravines made by streams descending the slope. These are enumerated here because they are often cited as criteria for the recognition of true fault scarps.

The Kern River scarp lacks the decisive indications of a fault scarp. It has no rift features, no alluvium or lake basin on the downthrown side, and its relief varies from twelve hundred feet to nothing within short distances. The correlation between topographic form and rock hardness is excellent, for the highland is only on the granite, and the lowland is only on the soft Miocene deposits. It has, therefore, the essential characteristics of a fault-line scarp.

The deceptive characteristics of this scarp, which have led to its diagnosis as a fault-scarp, now call for explanation. The linear base of the escarpment is due to the much more rapid removal of the soft beds on the southwest side of the fault by tributary streams, which have extended their ravines rapidly to the northwest and southeast. The nearly unconsolidated Miocene formation has been cleaned from the adjacent granite mass, thus leaving a wall of the latter which has weathered back scarcely to the angle of repose. In the same length of time, the powerful Kern River has made the V-shaped notch in the granite plateau, but its small tributaries in the granite have been unable to cut more than short ravines. On the face of the scarp itself, slope-wash has started a few V-shaped gullies in the granite; but the removal of the Tertiary deposits from the base of the scarp has been so much more rapid than erosion in the granite that the lower ends of some of these ravines have been left hanging far above the base of the slope, thus simulating, in a remarkable degree, the dislocated ravines characteristic of true fault scarps. Exceptionally clear triangular facets, which are commonly regarded as evidence of real fault scarps, have been developed by the deepening of these ravines.

Under the circumstances, it is not surprising that the Kern River scarp should have been interpreted as a young fault scarp. The condition illustrates the fact that physiographers need a clearer understanding of all the criteria for the recognition of fault scarps on the one hand and fault-line scarps on the other. The two kinds simulate each other so closely that it is difficult to distinguish them without painstaking study, or at least without consciously comparing their special characteristics with the case under observation.

THE STATUS OF SERICULTURE IN ITALY

W. O. BLANCHARD

Italy dominates the raw silk market of Europe to about the same degree as the Far East does that of the world as a whole. The proportion in each case is about 90 per cent. Of the total world output of 75,000 to 100,000 metric tons of raw silk, the Italian contribution of 4,000 to 5,000 metric tons, or about 5 per cent, is of small consequence.

Sericulture is one of the oldest Italian industries, the breeding of silk worms having been introduced into Sicily in the early years

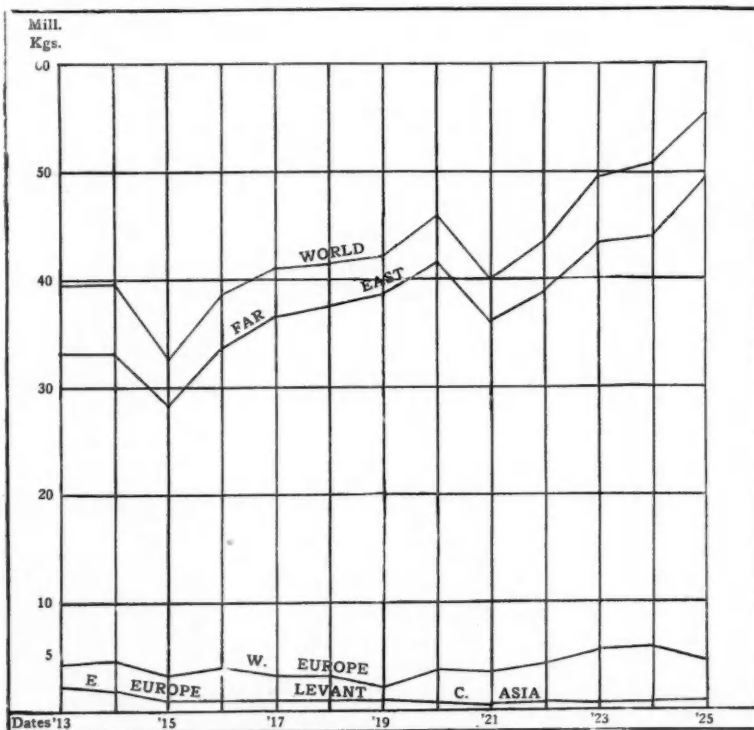


FIG. 1. WORLD PRODUCTION OF RAW SILK BY REGIONS

Data for China were computed from the exports of Shanghai and Canton plus that of Tussak silk, on the basis of the estimate that 53 per cent of the production is consumed locally. Data from U. S. D. C.; Silk Association of American and International Econ. Confer. Documents.

of the twelfth century. Italian silk brocades, damasks, and velvets were famous throughout the Middle Ages. Unlike the other textile industries, the manufacture of raw silk depends almost wholly upon a domestic supply of raw material. Some cocoons have usually been imported but the proportion is small and has been diminishing. In 1923 over 94 per cent of the cocoons used were of Italian origin.

In Italy, as in France, raw silk production has been placed on a scientific basis and the work associated with each of the various stages of production has been highly specialized. This is particularly true of the selection of breeding stock and the preparation of the eggs which is in the hands of some one hundred fifty establishments whose annual output of a million ounces of eggs has a value of from 60 to 70 millions lire. Their work is closely regulated and inspected by the government which also operates in Padua and Ascoli Piceno research sericulture stations. In addition to the aid and the rigid regulation of the national authorities, practically all the breeders and egg producers are associated in a Federation designed to protect and develop the industry. The eggs carefully selected and inspected, are sold to the rural homes chiefly in north Italy where they are incubated and the cocoons produced. Disposed of to the great cocoon markets of Milan, Turin, Como, and other cities, they provide the raw material for the mills of those districts which reel, throw, or spin.

As a result of the careful organization and scientific methods used, sericulture farmers of Italy realize much larger returns than do those of China. In the latter country it is estimated that 75 per cent of the worms die before hatching and one ounce of eggs yields from 15 to 25 pounds of cocoons. In Italy, on the other hand, the proportion of defective eggs, which thirty years ago ran up to 25 or 30 per cent, has been reduced to from 5 to 8 per cent and an ounce of eggs now produces from 110 to 133 pounds of cocoons. Like wise the quantity of cocoons necessary to produce one pound of raw silk has been reduced from 14 or 15 pounds to 10.¹ In short, one ounce of eggs in Italy may be expected to yield 12 pounds of raw silk as compared with 1½ pounds in China, or eight times as much.² The complete rearing of the worms from an ounce of eggs represents the equivalent consumption of almost a ton of mulberry leaves.

¹*The Italian Exporter*, Rome, Nov. 1926.

²*U. S. Com. Rept.*, December 12, 1925, p. 690.

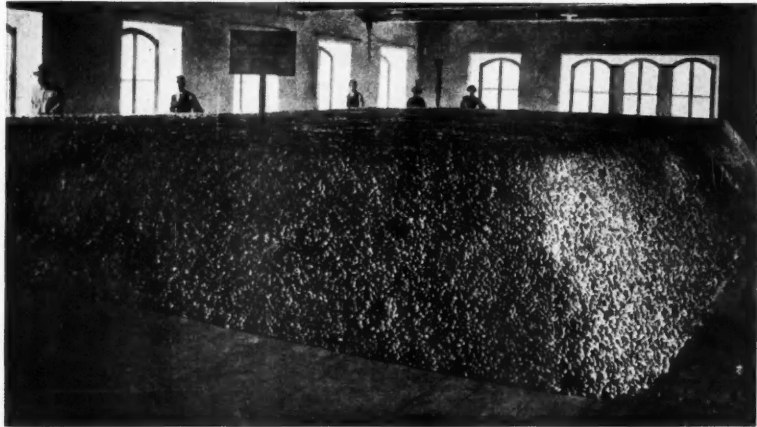


FIG. 2. A MOUNTAIN OF GOLD—A HUGE STOCK OF YELLOW COCOONS WAITING FOR THE SPINNER

The distribution of silk culture in Italy is controlled very largely by that of cheap skilled labor. The northern plains with their dense population, and the water power for the mills cares for the major part of the industry. The egg and breeding establishments are along the Adriatic coast of the Marches and Abruzzi and about the hills of Treviso, north of Venice. The industry of raising the cocoons is in the rural homes of the northern plains where 89 per cent of the total is produced. Central Italy accounts for 8.15 per cent and south Italy, 2.85 per cent. The mills are located in the districts about Milan, Turin, and Como, the latter having no fewer than 114 mills employing 22,400 workers in and about the city.

Many of the mills are scattered about in the open country rather than being built up into compact city blocks. As shown in Fig. 4 the establishments may be in the midst of open fields with only the plant and homes of the workers to break the succession of garden, meadow, and wood. The uses of electric power facilitates this scattering and aids in providing a setting for the industrial units in marked contrast to the ordinary smoke begrimed industrial centers of our own country. Milan rivals Lyons as the leading European silk center, yet the writer searched in vain for a silk mill in the city, as vainly as on a previous occasion he had looked for a steel mill in Pittsburg. It is from Milan, however, that the work is

directed. Here are the central offices and here are consummated the exchange and transactions in cocoons and raw silk.

In spite of the improvements in the industry, silk production in Italy, as in western Europe in general, is on the decline. True there has been an increase beginning in 1921, but it is a reflection of high prices and may be considered a temporary improvement, in fact the figures for 1926 and 1927 show a marked decline.



FIG. 3. SILK WORKS AT COMO

Note absence of great metropolitan industrial blocks. Factories in North Italy are scattered, often out in the open country side.

There are several reasons for the decline. The relative cheapness of labor in the Far East, a large item in the silk industry, is a major factor. With the rapid industrialization accompanying the development of water power in north Italy, wages and living standards there have risen, and there is a marked movement of the rural population to urban centers.

A second factor of far reaching importance is climatic. In southern China and Japan the climate makes fresh mulberry leaves available throughout much of the year and the worms produce several broods annually. There the work of cocoon raising is much more of a year-round occupation while in Italy and France it is highly seasonal and demands much labor at the same time as do the agricultural crops.

Lastly, the susceptibility of the worms, which have been reared under artificial conditions for so many centuries, to disease; the competition of rayon and the limited home market all have tended to discourage the Italian silk producer. Only care and scientific study have enabled the industry to retain a precarious hold thus long. Japan, where the advance in practise and improvement in methods, has also been marked, with its cheap labor, has shown a remarkable increase and even before the war was gaining at the expense of Italy. For the latter, the war interruption with financial difficulties following hastened a movement which was already well under way.

In Piedmont, rice, in Emilia, the vine and vegetable, in Tuscany, vegetables, and in the south, vine and fruit trees are taking the place of the mulberry. In few places do the mulberry trees alone occupy good agricultural land. They may be planted far apart in the vineyard or grain field or along the roadside or hedge-row, or more frequently still on land which is topographically unsuited to cultivated crops. During the war the scarcity of firewood led to the cutting of many of the trees.

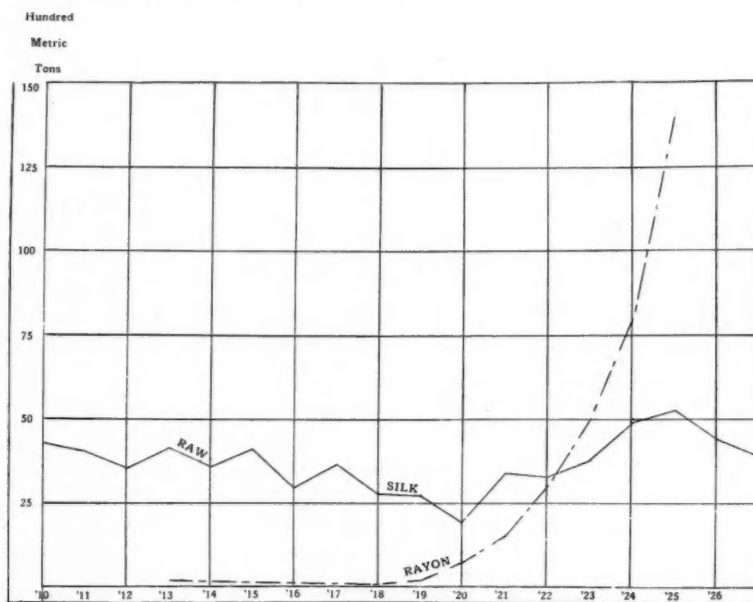


FIG. 4. RAW SILK AND RAYON PRODUCTION IN ITALY

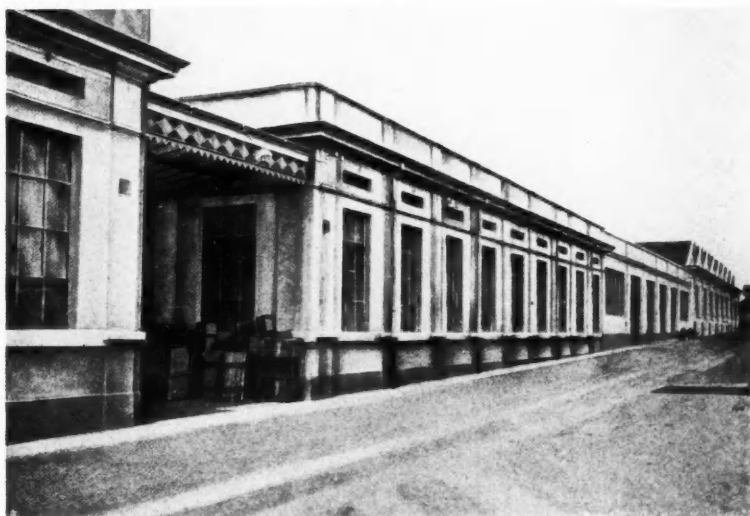


FIGURE 5. Central Entrance Into the Workrooms

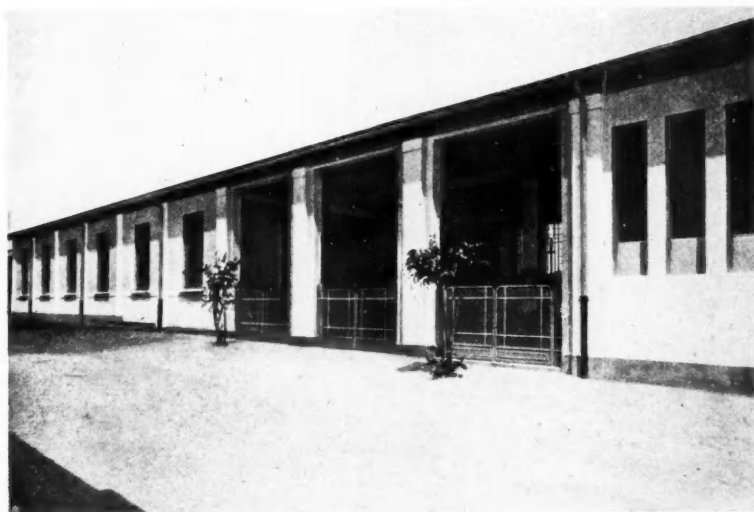


FIGURE 6. Workers' Entrance, Seen From Outside the Works.

The silk industry of Italy is dependent upon foreign markets, the home demand being of small importance. Thus of the 1923 output of Italian mills valued at four billion lire, 2.5 billion were exported. Raw silk has long been the leading item in the export trade.

A strong effort is being made to develop the manufacture of silken fabrics within Italy. However, the countries which are the principal markets for the raw silk have their own manufacturing plants protected by a tariff wall and it would be necessary for such manufactures in Italy to find markets in the newer, less developed countries. The future of the industry in Italy appears dubious, for even with wages in Japan rising, China will eventually adopt scientific methods and in fact is doing so now, so that she in turn will be a serious competitor in selling cheap silk.

The outlook for the rayon industry in Italy appears to be much more promising. Beginning in 1909 its development especially after 1922 has been remarkable. In that year it surpassed silk in tonnage for Italy and by 1925 its output was almost three times as large as the product of the silk worm. In this last year Italy ranked second only to the United States in production.

Unlike the raw silk industry, the manufacture of rayon is entirely a factory occupation and in Italy appears to be on a sound basis. It is favored by cheap water power, abundant labor, and a domestic source of the important chemicals, i.e., soda and sulphuric acid, and has a large domestic market. Unfortunately the attempts to use native poplar have been unsuccessful and imports of cellulose from Scandinavia and central European countries must be depended upon.

Like the silk industry, rayon manufacture is chiefly in the north. The capital invested had by 1923 reached a half billion lire and as indicated in Fig. 4 the industry is still expanding rapidly.

TITLES AND ABSTRACTS OF PAPERS

ROLLIN S. ATWOOD (Introduced).

The Physical Factors Affecting the Agricultural Utilization of the Southern Rocky Mountains.

Physiography as a direct and an indirect agent, plays the dominant rôle in the development and utilization of the Southern Rocky Mountains. This is especially significant in the distribution of land used for crops, pasture, and forests. The temperature and the amount of moisture are both directly affected by the physical features, and the different soil groups are found to be closely linked with the topography, temperature, and precipitation. In this mountain region the effects of the four physical factors which control agricultural production are shown especially well and express themselves not only in the distribution of the various crops, but in the natural vegetation.

There are several distinct altitudinal vegetation belts or zones and these are to a large degree a result of the changes in the temperature, in the supply of moisture, and to the different character of the soils, all of which vary with increased altitude. The different groups of soils are closely associated with the changes in natural vegetation and can therefore be most readily distinguished in this relation.

The following large communities of Colorado native plants have been recognized: the *grass steppe* or *short grassland* group of the Great Plains and the foothills; the *shrub steppe* group; the *chapparal* group; the *pinyon pine and juniper* group; and the *coniferous* forests. It seems very probable that the location of these zones of natural vegetation in this mountain region has been largely determined by the physical elements of the environment. The agricultural utilization and the possibilities for expansion can be closely correlated with the distribution of the types of natural vegetation.

WALLACE W. ATWOOD.

Some Open Problems in the Physiography of North America.

While we are celebrating this year the Twenty-fifth Anniversary of the founding of this Association and the work and inspiration of our founder, our minds naturally turn to the remarkable prog-

ress which has been made during the last few decades in the development of the science of physiography. There remain however, just as wonderful opportunities for further contributions. The principles of the science have been well established, but numerous field problems in which these principles must be applied await solution. It would not be difficult to outline sufficient work for the next twenty-five years for the entire membership of this Association in this one field of geographical research.

In this paper the open problems presented included:

The Physiography of the Rocky Mountain Region

The Physical History of the Basin Ranges

The Evolution of the Yukon Valley

The Correlation of Geomorphological Sequences in Adjoining Provinces

Analysis of the Physiographic Features of New England and Acadia

The Physiography of Mexico

Topography and Land Utilization.

NELS A. BENGSTON.

Significant Geographic Aspects of the Exploratory Period in the History of Central America.

From the chronicles of Columbus' last voyage to the new world comes the story of how storms and deep waters along the coast of Central America so impressed the sailors that they prayerfully exclaimed "Bendito Dios, que hemos salido de estas Honduras" (Saintly God, that we may be delivered from these depths). Thus, as a result of environment and human experience, came into being a term which has endured as a country's name for more than four centuries.

Columbus left Cadiz, Spain, May 9, 1502, on his last voyage to the new world. That his passage across the Atlantic was favored by steadily blowing trade winds seems clear inasmuch as he arrived off the Island of Santo Domingo on June 29th—a fast voyage in those times. Delays due to storm and necessary repairs for his vessel kept him there until July 14, when he again set sail for the mainland. Winds and currents swept him northwestward into the Yucatan Channel before he realized that he had been carried far adrift from his intended course. This necessitated his turning sharply southward, after which he reached the eastern-

most of the Bay Islands on July 30. To this island he gave the name Guanaja from the Indian name then in use, and this has remained its official name ever since.

Among the natives of Guanaja he found an old man who drew upon the sands a rough sketch map showing the coast of the mainland not far distant, but invisible from the island. This is the first record known of any sort of a map pertaining to the coast of Honduras. Taking the native map maker as a pilot, Columbus set sail and on August 14 landed and celebrated mass near where is now the town of Trujillo. From this point the expedition set sail eastward. The period of coastal storms and hurricanes delayed progress so that it was not until about three weeks later that the frail craft were able to reach the most easterly point from whence the coast veers southward. The sailors were so grateful for their deliverance that they named the place "Cabo Gracias a Dios," a name which has never been changed.

During the next twenty-year period explorations of Central America were conducted by various Spanish leaders in charge of independent expeditions from the north and from the south, from the Caribbean Sea, and from the Pacific Ocean. Cities were founded in strategic places, and grants connected with them were made to the leaders of the expeditions as rewards for their various exploits. These grants were usually clearly defined so far as the centrums were concerned but were poorly defined with respect to their peripheral areas. The terrane was found to be rugged and irregular with no outstanding topographic features to serve as guides in marking boundaries. This led to overlapping and conflicting claims and thus at a very early date instituted boundary disputes, some of which after four centuries of controversy, have not yet been settled, and are still serious menaces to international peace.

Much of the nomenclature used in Central America has geographic significance and the forms of the various countries as well as their location and problems are directly related to geographic aspects of the environment. An essential in the solution of many of the Central American industrial and political problems is a fuller understanding of the geographic features of the countries. For such understanding there is considerable material available although not organized into form for general use. Geographers are confronted with the tasks of organizing the scattered data and of arousing in the consciousness of officials and of business men

an appreciation of the desirability of geographic knowledge in the handling of Central American problems.

MILLICENT TODD BINGHAM (Introduced).

A Method of Approach to Urban Geography.

The city is not only a legitimate subject for geographical analysis, it is the epitome of regional geography, its elements being physical factors such as topography, soil, climates, waterways, and human factors such as industrial possibilities and routes of communication. The study consists of three parts: first, geographical factors of a city's location and growth; second, reactions of the city to such factors; third, essential character of the modern city, an understanding of which is the objective. Maps, censuses by districts, records of city bureaus, industries and public utilities, traffic statistics, such are some of the tools. But how are they to be used? Historical method is shown to be the crux of the problem. A parallel is drawn between the history of land forms, which elucidates the present landscape, and the history of a city, which reveals its type, its function and pictures its present stage of development. An historical event, *per se*, has no geographical significance. That inheres, not in the character of any event, not even in whether it occurred in the past or is a factor still operative, but in the effect it had, or is having, upon a geographical organism, such as the city. It is pointed out that since our emphasis is on other things, few of the geographical elements of fixation, so-called, of ancient cities would carry weight today in selecting a site. Likewise, historical factors chosen for analysis of the venerable cities of Europe may or may not be the same in character as those chosen for analysis of our own.

S. W. BOGGS (Introduced).

Geographic Aspect of European Emigration to the United States.

Intercontinental human migration during the last century has been unparalleled in volume, in regional extent, and ethnic variety. Probably it will never be equaled again. To the United States alone nearly 16,000,000 immigrants came from all parts of Europe in the thirty years, 1890-1920.

A geographical analysis of the immigrant stream was necessitated by all three of the quota schemes which have been embodied in American law—tracing immigrants not simply to the country of their origin, but, further, to the smaller province or region in which they were born, at least in countries which have experienced territorial losses. The importance of the geographical phase in the determination of the quotas may be appreciated when it is realized that in 1907 55 per cent of the European immigrants to the United States came from countries which have lost territory since 1918, and that one-eighth of the population of Europe changed sovereignty following the World War.

A study of the geographical aspects of European migration to the United States, which has occupied considerable portions of the writer's time during more than two years, has led to two broad generalizations.

The first is that, since the Industrial Revolution, immigration has come predominantly from European areas which had not yet become industrialized, and in proportion to their accessibility to trans-Atlantic transportation, and that it has been absorbed in the part of the United States which was becoming industrialized. From the agricultural regions of Europe, increasing in population to the point of saturation, have poured millions of immigrants to our eastern states. As industrialization spreads in Europe, those regions diminished their emigrant stream. As railroads and steamship routes tapped new territory, new foci of emigration developed.

The second conclusion is that in regions of ethnic and linguistic complexity, once the emigrant stream sets in it embraces all elements of the population. That is, emigration is regional rather than racial.

CHARLES F. BROOKS.

Rainfall of New England.

New England's position where the tracks of lows converge and its proximity to the abundant supply of vapor over the Gulf Stream make this region one of good rainfall, well distributed through the year. Orographic control of rainfall distribution is in evidence, particularly in the White and Green mountain regions.

In the cold season there is moderate though frequent precipitation in lows passing a short distance north of New England, and abundant falls of rain and snow that attend storms brushing the coast or coming in from the sea. Thus the January average rainfall map shows precipitation from as much as two inches in the north and northwest to three, four, and locally even five inches near the coast.

The summer rainfall, while still cyclonic in large measure, is much more convectional in type. That is, when the weak lows of summer are passing, their general conditions favor the local thunderstorms, which bring rainfall chiefly to the interior, and especially on the White Mountains. Coastal storms seldom occur. Furthermore, the cool waters along the coast hinder the development of heat thunderstorms. Therefore, the interior has more rainfall than the coast. The average in July, for example, is generally four to five inches in the interior, and under four to less than three inches on the coast, Mt. Washington being wettest and Cape Cod, Nantucket, and Martha's Vineyard driest.

Fairly uniform seasonal distribution marks all of New England, with, however, a distinct summer maximum well in the interior and a winter maximum on the coast. Between, the rainfall is nearly the same in all months.

The average annual rainfall distribution is marked by a broken belt of heavier rainfall not far from the coast and another on the highlands. The 40-45 inches of the immediate shore is less than the 45-50 inches of 20 miles inland. Fifty miles inland comes a belt of lower precipitation, 35-40 inches, except where highlands keep the rainfall up. And farther inland still the hills and mountains are marked by 40-50 or more inches. Pronounced interior lowlands, however, like those of the upper Connecticut and upper Androscoggin, must get along with 35 inches or less. The Lake Champlain lowland, in the rain shadow of both the Green Mountains and the Adirondacks, and with the summertime reducing effect of the cool lake has the lowest rainfall, from 35 to less than 30 inches. The absolute maxima are generally a third again as great as the averages, while the minima are about a third off.

Acknowledgments are due the U. S. Weather Bureau and the Massachusetts Department of Public Health which supplied the data for the 45-year period, 1881-1925, used; to J. Henry Weber, who compiled, averaged, and adjusted most of the data, and pre-

pared the maps and detailed discussions for the annual and seasonal rainfalls of New England as a whole and for the monthly rainfall of southern New England; to Dr. Gragg Richards, who reduced, mapped and discussed northern New England, and to the New England Water Works Association, which published these studies in its *Journal* (Vol. 42, 1928), and which, with additions, will bring these out in book form, in 1929.

KIRK BRYAN.

Flood Water Farming.

The use of flood water as a means of irrigation has been much practiced by prehistoric and modern man. In some localities simple works for warping the water across the land are used. In other places only sites subject to overflow are cultivated. Examples of fields farmed in this fashion in New Mexico are described for the purpose of setting forth the geographic factors in the location of fields. A stream valley undergoing aggradation is most favorable for the location of fields but even here the number of sites is limited.

The dissection of stream valleys that began in the Southwest 50 to 75 years ago has made many localities unsuitable for this type of farming. A similar regional change from aggradation to erosion took place in late prehistoric time and by the reduction in area and redistribution of suitable sites for cultivation was doubtless a large factor in the changes in prehistoric culture that occurred almost simultaneously.

The successful cultivation of a flood water field requires an intimate knowledge of local conditions of rainfall and run-off but a further study of the principles involved may lead to practical devices that will greatly increase the efficiency of the method under modern conditions.

HENRY C. COWLES.

Some Aspects of Utah Crops and Vegetation.

Utah is rich in natural vegetation types, extending from the hot region in the south to the alpine zones of the mountains, from the drought of the cactus desert to the high rainfall of the montane forest, and from the alkali of Great Salt Lake to the acid areas in the Uintahs. The varying vegetation types are briefly noted and

attention was paid to the remarkable variations that these diverse areas indicate as to crop possibilities.

V. C. FINCH.

The Service Area of Montfort: A Study of Landscape Types in Southwestern Wisconsin.

Montfort, Wisconsin, is one of a series of villages situated on the military ridge on the crest of the Galena-Trenton escarpment in the southwestern part of the state. It serves as the center of an area some 60 square miles in extent. Although this area is in most respects an economic unit it contains landscape forms that in many ways are types of those which characterize the whole southwest corner of the state. It contains (1) visible evidences of a decadent lead and zinc mining industry, and (2) three sub-areas with some measure of contrast in characteristics of slope, soil, racial stocks, types of farming, percent of cultivated land and land values. The first of these sub-areas is a nearly flat, highly cultivable upland, which had originally a prairie vegetation. It lies on the back slope of the cuesta at the headwaters of the Pecatnoica River. The second is an area of rolling surface originally prairie and open woodland, at the headwaters of the Platte River, also on the back slope of the cuesta. The third area is the escarpment slope, deeply dissected by the Blue River and its tributaries. Here many branched ridges with their bordering terraces constitute the only cultivated lands.

V. C. FINCH.

The Geographer's Feld Map as a Permanent Record of Landscape Forms.

One of the products of field work in the Montfort, Wisconsin, area was a field map recording the distribution of forms in the natural landscape as overlain by the forms of the cultural landscape. It is believed that this map demonstrates the ability of the geographer, equipped only with a plane-table and open-sight alidade to obtain in an area data of permanent value in fields other than geography. The paper developed some of the various possibilities of such a map.

OTIS W. FREEMAN (Introduced).

Economic Geography of Hawaii.

Hawaii has 6,454 square miles, only 10 per cent of which is under cultivation, yet exports \$110,000,000 annually which represents nearly \$400 per capita. This result is obtained through: (1) skilled management of sugar and pineapple plantations; (2) fairly cheap and efficient labor of Japanese and Filipinos; (3) favorable soil and climate; (4) good transportation to the mainland markets where there are no tariff barriers. Fifty-one plantations in Hawaii, Oahu, Maui, and Kauai produced 800,000 tons of sugar, worth over \$70,000,000 annually. Much of the cane is raised by irrigation which requires a large investment as the water sources are often remote from the fields. Sugar is raised on lowlands and gentle slopes below 1,000 feet. Pineapples require no irrigation and can be raised above the cane up to altitudes of around 2,200 feet. Canned pineapples account for \$38,000,000 of exports and the fruit is raised on Oahu, Maui, Lanai, Molokai, and Hawaii, mostly on plantations owned by the large canneries but a minor part is produced by small growers. The success of pineapple and sugar culture in the islands has been helped by: Invention of machinery there for manufacturing the crops, skillful salesmanship, and elaborate means of improvement of plants and the methods of agriculture, fertilizing, and protection against diseases and insects. Other exports are coffee, \$800,000, bananas, \$250,000, and hides, honey, wax, canned tuna, vegetables, etc., \$500,000. Rice is grown but \$3,700,000 per year is now imported. Many millions of dollars a year are spent to import fresh fruit, vegetables, dairy products, eggs, meat, poultry, and other food stuffs as well as nearly all kinds of manufactured goods. Imports amount to \$84,000,000 per year, of which \$73,000,000 comes from the mainland and the balance from many parts of the world. Ninety-eight per cent of all exports go to continental United States and San Francisco receives 91 per cent of them, including all the sugar which is refined there. In Hawaii two money crops, sugar and pineapples, are used to buy most of the foodstuffs and other commodities that the 300,000 people of the islands consume.

J. PAUL GOODE.

A New Projection for the World Map; the Polar Equal Area.

No abstract. Paper to be published in June number.

CHARLES GOOZE (Introduced).

The Economic Geography of Northern Mendoza: An Argentine Oasis.

The irrigated lands of northern Mendoza afford a noteworthy example of unilateral development resulting from suitability of physical conditions to the cultivation of a principal crop—the vine. Under the influences of desert climate, fertile alluvial fan soil materials, and easily employed irrigation waters, however, since early days human response has manifested three distinct types of agricultural economy in this region.

Utilizing the facilities provided by an abandoned channel of the Mendoza River, Inca engineers completed an irrigation canal to render possible a subsistence agriculture for their subject tribes in the Mendoza area. The Spaniard, accustomed to the régime of irrigated lands, devoted his efforts principally to an exploitation of advantages, arising from the piedmont situation of the oasis, for fattening cattle on their way to Chile; a practice followed to a diminished degree to the present day. With the opening of rail transport to Buenos Aires, the Argentine found wine a commodity most suited for yielding profits after the six hundred mile journey to the seaboard. As a result viniculture has established a rich Mediterranean agriculture in northern Mendoza, one in which population elements, largely Spanish and Italian in origin or derivation, occupy the land to the extent of 457 per square mile over the 713 square miles embraced in the cultivated area.

In recent years, however, the region has come to realize the portent of over-specialization. Acreage in vineyards has shown no slackening in rate of increase, despite preliminary signs of over-production. Natural factors, on the other hand, now serve to point out to the cultivator the error of his ways—to point out the necessity for diversification.

W. H. HAAS. (Published in March number.)

The Mississippi Problem—A Conflict in Economic Emphasis.

Two great problems in the Mississippi Valley are engaging the attention of people at large but especially those most vitally affected. Both problems have been more or less serious during the entire period of development of this area, but they have become especially so with the increased pressure of population and produc-

tion. In the one case the problem has been the seeking of a water outlet to the sea for its mounting products, in the other for the control of the waters of this master stream which reasonably may be expected to furnish such an outlet. The need for a solution in both cases is great. Haphazard attempts with inadequate funds have been made to alleviate the situation, but the making of systematic plans that look to the ultimate solution of both problems has never had very serious consideration. Nor, and what is more serious, do we have at this late date sufficient information on basic principles to outline such plans now. And what perhaps may be still more serious is that thus far the plans for the solution of one problem as carried out have had a tendency to intensify the seriousness of the situation in the other. However, with this lack of fundamental data only the broader outlines of a comprehensive plan which looks forward to the ultimate solution of both these problems can be traced. The crying need of the present is the collection of basic data vital to the ultimate and complete solution of these problems, for without such data planning is only guesswork and the work done mere temporizing.

ROLAND M. HARPER.

A Regional Study of the Climate of Georgia.

Most studies of the climate of single states or similar areas, if illustrated at all, seem to have used maps for the whole area or graphs for single stations, or both, with little or no suggestions of regional treatment; or sometimes figures for the whole state are averaged, thus completely obscuring significant local differences.

When a state is divided into natural regions based on topography, soil, vegetation, etc., there may be no perceptible change of climate at their boundaries. But at the same time no two regions have exactly the same climate, and when the records for several or all stations in a given region are combined, the resulting curves are smoother than those for single stations, and some significant contrasts between different regions are brought out.

Some graphs for precipitation, temperature, growing season, etc., in Georgia, both annual and secular, made in this way were shown.

RICHARD HARTSHORNE.

The Manufactural Geography of the Central Northwest of the United States.

The small importance of manufacturing industries in the central Northwest (Minnesota, Dakotas, and eastern Montana) of the United States, where non-geographic factors are all presumably conducive to its development, makes this an advantageous area for the sort of elementary study that is needed in the geography of manufacturing.

This paper presented the results of a preliminary statistical survey. Only twenty-five industries, constituting nearly three-fourths of the total, are sufficiently important to require study. The comparative importance of each of these was determined by several different measurements. The relative development of each in the region was compared with that in the country as a whole to determine to what extent the region is more or less than self-sufficient in that industry. On this basis only five industries are found to be "surplus" industries; in a larger number the region is self-sufficient, but in a very much larger number it is deficient.

Nearly all of the industries studied can be classified into two groups: those dependent almost entirely on raw materials of local production; and those dependent almost entirely on local markets. The first group includes the five surplus industries and but four others. They reflect, both in nature and, with certain exceptions, in extent of development, the specialized types of primary production in the region. While a few of this group are examples of the type of industry which is necessarily located near its source of raw materials, the larger number are influenced in their location by several factors. The second group includes all but a very few of the other industries of the region.

Strikingly lacking in the region are industries whose location is greatly influenced by locus as to either power or labor. This reflects the two major handicaps of the area, namely its remoteness from coal fields and from the areas of dense population.

The map of the distribution of manufacturing in the region shows simple and notable concentration; one center, the Minneapolis-St. Paul metropolitan district, accounts for about half the total of the region, a minor center at Duluth represents about one-sixth, while the remainder is scattered in small cities and towns throughout the region. These latter include particularly those

industries which are, of necessity, closely tied to either their areas of raw material production, or to their consuming markets. The concentration in the Twin City center is the result of a number of factors, chief of which is its advantage as the great railroad focus of the region.

The relative importance of manufacturing to the population of either or both of the cities constituting this single geographic center is measured, and found to be much lower than in most cities in the eastern United States.

GEORGE D. HUBBARD.

Geographic Conditions, Influences, Controls.

By definition the field of Geography is the "relationship between man and his environment." Many terms are employed to express this relationship, such as geographic conditions, influence, controls, principles, and laws.

Physiographic, climatic, soil, resource, and human factors are recognized. Factors of position, of past history, even of possibility are described. Man adapts himself to his environment and changes the aspect of the country to suit his needs. Some seem to see geographic determinism, others only geographic setting. The paper discussed and strove to evaluate some of these terms.

LESTER E. KLIMM (Invited).

The Port of New York.

This paper was designed to serve as an introduction to the excursion of the Association around the Port of New York. It included among other things a presentation of the importance of the port in the commerce of the nation, the effect of the general topography of eastern United States on the early growth of the port, the railroads now serving it, and the situation with regard to railroad rates to New York as compared with those to other Atlantic ports. A brief outline of the layout of the harbor and its ramifications was presented and the location of the great terminals which fringe it was pointed out. An examination was made of some of the handicaps arising from congestion and the location of so much of the port's population and business on islands, thus making railroad communication difficult, together with a summary of the Port Authority's plan for the meeting of these problems and the general improvement of the port.

MARK JEFFERSON.

The Panamanians.

On Francia Point in Panama City is a striking monument—

“ TO THE FRENCH

SAPPERS OF THE INTEROCEANIC CANAL ”

Panamanians built it there and supplied it with ten tablets of sonorous Spanish to tell the tale. On the tenth and last of these tablets the people of North America come in for mention. It is admitted that we had a part in finishing the work.

The Panamanians have been living at Panama since 1519 in a situation as pleasant and healthful as the greater part of the line of the actual canal is rain-drenched and pestilential. The work of foreign scientists has lately made possible the construction of a rainfall map of Central America which reveals Spanish creole cities placed at every drier part of the region. With great hardihood and intelligence they have found all the habitable spots in the midst of so many mountain swamps and jungles.

Panama is the home of intelligent people on the favored Pacific side of the Isthmus. These creoles lead pleasant lives. They have pleasing manners and their houses have most distinct charm. They are, as they view it, in their own country, sovereign even in the Canal Zone, where they have granted us merely “absolute use and control” for the ends of interoceanic navigation.

It is a fact, of course, that Frenchmen tried between 1879 and 1889 to build a canal at Panama and failed, after spending thousands of French lives and hundreds of millions of French dollars to little effect, that a French court sent de Lesseps to the penitentiary for maladministration, that the United States between 1904 and 1914 took over the task, changed the plan, and built a satisfactory canal. They spent four hundred millions on the undertaking, giving the French company forty for its rights and its property.

The Canal is a most impressive manifestation of the wealth, the power, and the engineering capacity of the United States, but the French, though they failed to achieve a canal or any important part of one at Panama, did win the liking of the creole Panamanians by a tactfulness which we have never even tried to emulate. That is the significance of the Gallic monument on Francia Point.

MARK JEFFERSON.

Regional Culture and the Geography of Patent Grants.

According to data published by the United States Patent Office, for each thousand people in their respective countries, Belgium issued 37 patents between 1870 and 1922, Canada 25, the United States 12, and Holland 1. One may not infer that Canadians are twice as inventive nor Belgians 37 times as inventive as the Dutch. Culture is regional, as shown by the culture study of 1911. Neighbor nations have similar culture grades. Studies for 1925 confirm this for the new nations too, though we include five new criteria, of which inventiveness is one.

What happens is that Canada granted six or seven times as many patents to "residents of the United States" as to residents of Canada—in 1925, 7892 against 1292. The United States in the same year listed about a tenth as many patents granted to residents of foreign countries as to citizens of the United States. If we leave out from the patents granted by each country those granted to residents of other countries, the patents issued in 1925 for each hundred thousand inhabitants of the respective countries turn out to be: In the United States, "to citizens of the United States" 36, in Belgium to Belgians 28, in Canada 14, and in Holland five. However, we do not believe the Belgians are even five times as inventive as the Dutch. One wonders if Belgian patents are peculiarly easy and inexpensive to take out—whether the country offers special incentives to getting patents that Holland does not offer?

To avoid such differences in countries we consider here only the sum of the inventors in any country who took out patents in 1925 in any other than their home country, all thus having, whatever their own country, the same patent offices to which to apply and the same group of opportunities or hindrances to encounter. We are to compare the numbers of Dutchmen, Englishmen, Belgians, and Germans who take out patents in foreign lands to get a notion as to how much inventiveness is being given practical effect in different countries.

And on mapping the data it comes out that regional similarities of values make estimates possible for countries which supply no data. Portuguese citizens who take out patents abroad are of course reported by the English, French, Dutch, and German patent offices. That Portugal makes no report only requires estimates

to be made of the number of Englishmen and others taking patents in Portugal, and these can be estimated.

For each hundred thousand inhabitants of the various countries in 1925, 30 Swedes, 23 Norwegians, and 24 Danes took out patents abroad. So did 19 British, 22 Dutch, 21 Belgians, 20 Frenchmen and 29 Germans, and 4 Rumanians, 2 Bulgarians, 1 Greek and 1 Turk. The study is really European, and Canada and the United States are too distant to compare, but their figures are 16 and 11.

W. L. G. JOERG. (To be published in June Annals.)

Memorial of Cyrus C. Adams.

No Abstract

WELLINGTON D. JONES.

Ratios in Regional Interpretation.

Certain ratios have long been employed by geographers in regional interpretation, notably the ratio of population to area, which ratio is the basis of density of population maps.

Certain other ratios not uncommonly have been set forth in statistical tables, but all too rarely have been used as the basis of maps. Such, for example, is the ratio of area under crops to total land area.

Still other ratios remain to be discovered, or if discovered, to be much used by geographers, either in statistical tables, or as the basis for maps. For example, various ratios between crops and livestock or livestock products may very probably be found to be as useful in regional study as any of the few ratios now commonly employed. These ratios, and many others, once determined, might be used as identifying index figures for various types of farming, and isopleth maps made from these ratios may prove helpful in determining the areal spread of different farming systems.

Half a dozen maps, based on various ratios, were presented, one of India showing the ratio of area under crops to total land area; another of India showing, after the manner of Engelbrecht, agricultural divisions of the country according to the dominant grain crops; two maps of Australia, showing density of sheep and density of cattle per square mile, with gradations of equal intensity as to animal units so that the two maps are directly comparable;

a map of Australia showing a proportion of total land area that is under crops in different parts of the country; a map constructed in the attempt to delimit the dairy sections of the United States, showing the ratio of the number of gallons of milk produced in a year to the number of acres in crops.

The illustrations given were for the most part from the field of agricultural geography. Analogous ratios, however, probably can be worked out in other regional phases of our subject. Urban areas, for which detailed statistical data are available, offer a rich field for experimentation. The general method is applicable in detailed field survey as well as in study with published statistical material.

H. M. LEPPARD (Introduced).

An Experiment in the Reclamation and Utilization of Cut-Over Land in the Upper Lake Region.

The Triangle Ranch represents a unique experiment in the use of cut-over land for the rearing of beef cattle. The ranch, containing 8000 acres, is located in Iron County, Upper Peninsula of Michigan. The Hereford herd consists of 1200 to 1800 head of stock; and improvements include 1800 acres of land in crop, five barns with a total capacity of 1500 head of cattle and 2500 tons of fodder, and living quarters for 100 people. The capital investment is \$500,000.00.

The investigation of the geographic aspects of the enterprise was undertaken at the invitation of the management. The findings are based on work in the field which included the making of a detailed areal survey, the photographing of the ranch holdings from the air, and the tracing of the history of ranch operations through the examination of nearly 3000 daily "work sheets."

The ranch was founded in 1920 as a summer grazing enterprise, but financial losses led to the establishment of a permanent herd. The need for large quantities of winter feed necessitated a heavy land clearing program and large scale agricultural operations.

Most of the problems of land clearing, agriculture, and stock raising have been successfully solved. The most critical problem of present ranch economy, and one as yet unsolved, is the production of enough additional winter feed to permit the size of the herd of breeding stock to be increased by fifty per cent. If prom-

ising experiments in the substitution of sunflowers for part of the hay crop prove successful, the requisite herd of 1800 head of breeding stock probably can be carried through the winter. In that case the net income from logging operations, fur farming, and "dude ranching," now being successfully developed, will increase the dividend on the whole enterprise. If the size of the herd cannot be increased by changes in crop practices, the profits on the supplementary operations indicated will probably more than balance any deficit on stock raising due to the inadequate size of the herd.

ALEXANDER McADIE.

The Third Estate of Geography.

Geography in a broad sense is the study of man's environment and reaction thereto. As shown later we may define geographics as man's curiosity concerning his whereabouts. Homocentric no doubt; but even when conscious of our place in the universe as parasitic growth on an ashheap in a backyard, we may still indulge our vanity in the belief that man is the end for which all creation was made.

There are then, four estates in our new geography; first, the old-fashioned two-dimensional geography of our fathers with no mention of the under-earth or the structure of the geoid; second, hydrography or study of surface waters, now changing to a three-dimensional science with sonic depth finders and devices for recording salinity, density and mass movements of the waters. The third estate is aerography, the study of the structure of the atmosphere, also three-dimensional; and which it is the main purpose of this paper to consider, with regard to recent explorations. The fourth estate will come as a surprise to most of us, for it is that branch of geography which treats of regions beyond the thinnest air, space in which our little *gea* is bouncing along, a very small ball on a very large river. We propose to call it astrography, a more comprehensive term than astro-physics. We hold that the efforts of our colleague (Shapley) and other astronomers in exploring the galactic belt, which we all see on a clear night across the star-crowded vault is essentially a study in geography. Therefore we define geography as "the curiosity of mankind concerning its whereabouts."

Briefly we define the four estates in geography as (1) geographics; (2) hydrographics; (3) aerographics, and (4) astrographics.

A discussion of recent advances in exploring the atmosphere followed. Mention was made of the work of the International Commission for Exploration of the Upper Air under the leadership of Sir Napier Shaw; and what is planned.

LAWRENCE MARTIN.

Rivers as State Boundaries.

The paper was a compressed analysis of all the State boundary cases which have been submitted to the Supreme Court of the United States or to Congress. A large map showed the distribution of the main types of boundaries within our country. Upon the basis of the numbers of cases involving (a) mountain boundaries, (b) conventional boundaries, and (c) water boundaries, it was argued that river boundaries appear to constitute the worst and least desirable type.

JOHN E. ORCHARD.

Can Japan Develop Industrially?

The industrialization of Japan was encouraged at first as a measure of national defense, for it provided modern military equipment and it promised to protect the country from the economic exploitation that had been visited upon China and the lands of southeastern Asia. In more recent years industrialization has been encouraged to provide employment for the rapidly increasing population.

The Japanese government has participated actively in the development of modern industries. There is scarcely an industry that has not received government assistance and few are able to continue without the support of subsidies or tariffs. Japan, however, is still far from being an industrial nation in the European or American sense. It is only in comparison with the other Asiatic countries that she has made any marked industrial progress. Agriculture is the principal economic activity of the people. Comparatively few workers are employed in the factories. Most of the manufacturing is carried on in small establishments differing little from the industrial establishments of the Tokugawa period. Even in industries producing manufactured goods for export, the organ-

ization and the methods are essentially those prevailing in England prior to the Industrial Revolution.

Only in two industries—the spinning of cotton yarn and the making of heavy iron and steel products—has westernization been at all complete. The iron and steel industry is of little economic importance despite the fact that it has probably received from the government more assistance than any other industry.

Not only has there been little industrial development in Japan but there is slight prospect of any great development for the future. Coal reserves are not large and much of the coal will not coke. There is practically no iron ore. The textile industries will continue to be the important industries. They depend upon cheap labor and upon markets and in neither is Japan's position secure. An analysis of the labor situation in Japanese textile mills reveals that the labor supply is neither abundant nor especially cheap.

The most important export is raw silk. The market is being threatened by artificial silk and it is probable that China will become an important factor in the production of natural silk for world trade.

Japan's greatest market for her textile goods, other than raw silk, is China and the other Asiatic countries, but the more densely populated countries of the continent have industrial ambitions of their own and are attempting to develop textile manufacturing. It is certain that one of the first acts of China, unified and with tariff autonomy, will be to erect a tariff wall against the importation of all goods that can be manufactured within the country. Japan will be the principal sufferer.

JOHN L. PAGE (Introduced).

Rainfall of Mexico.

New rainfall maps of Mexico based on a seven-year period, 1921-27, show the following facts: There is a heavy rainfall on the Gulf coast belt of Mexico from Tampico south and east to the State of Yucatan. As is to be expected, the heaviest rainfall is not on the immediate coast but along the seaward slopes of the Sierra Madre Oriental, the greatest recorded amount being 3698 mm. at Teapa, Tabasco. The interior stations of the State of Yucatan receive twice as much rainfall as Progreso, the only coast station in the State. On the Pacific Coast from northern Nayarit southward the rainfall is abundant, although less than on the Gulf

Coast, and ranges from 1000 to 2400 mm. Northward from Nayarit there is a decrease of rainfall from 1000 mm. to almost none. In the interior of the country relief appears to be the great control of the rainfall distribution, there being differences of more than 1500 mm. in relatively short distances.

May to October are the rainy months in all Mexico except the extreme northwestern part where the Mediterranean rainfall régime is found. There is an area in eastern Oaxaca and western Chiapas and another in the States of Morelos, northern Guerrero, eastern Michoacan, and southern Mexico, where more than 95 per cent of the total annual rainfall occurs during this season.

There is an abrupt change from the rainy to the dry season and vice versa.

RODERICK PEATTIE (Introduced).

Andorra: A Study in Mountain Geography.

The independence of Andorra is the result of peculiar circumstance of the Pyrenees. Elsewhere in the mountains the separatist movement has been common. The country has two distinct levels of life, the relief between them being 1500 meters. Economically the two levels are differentiated into the pastoral and the agricultural. The importance of the sunny slope and the shady slope is great. Consideration of the height limits of fields involves a great many other factors than altitude and exposure modifications of temperature. Manufacturing is unimportant. The quality of social life has progressed but slightly for centuries. Isolated villages have strong economic independence and are apathetic toward change. The modern economy of the adjoining countries is about to change Andorran life rapidly.

RAY R. PLATT.

Progress on the Millionth Map of Hispanic America.

The Department of Hispanic American Research of the American Geographical Society was organized in 1921 for the purpose of carrying out an intensive program of studies into all phases of the geography of Hispanic America. As the first step in this program it was necessary to compile a new map of all of Hispanic America because such general maps as exist are so inaccurate that

they cannot be used as the basis for any sort of detailed geographical studies and because progress on the elaborate schemes of topographic survey under way in many of the Hispanic American countries is necessarily so slow that maps of Hispanic America must for a long time to come, be compiled maps.

Maps of Hispanic America produced by commercial map firms are not up-to-date because to collect the enormous quantities of surveys that have been made in Hispanic America particularly in the past twenty-five years would be too costly a task for a firm that must sell its maps at a profit. Even the assembling of such surveys as may be considered available because they have been published in scientific journals, government reports, books, and sheet maps is difficult because collections of these are incomplete, scattered, and not cataloged. The two most important sources of compilation material—surveys made by the Hispanic American governments for various development projects and surveys made by domestic and foreign development companies for the exploitation of natural resources—are almost completely unavailable to commercial cartographers because of their form and their confidential nature. The American Geographical Society has been able through its connections in Hispanic America to obtain a great deal of the original survey in the archives of the Hispanic American governments. Because of the continental scope of the map and the studies to be based on it many American and European development companies with interests in Hispanic America are interested in the production of the map and are contributing their surveys. As a result the Society's collection of original surveys in Hispanic America is now the largest in the world.

The map is being produced on the scheme of the International Map of the World on the scale of 1:1,000,000, and according to resolutions passed at the last conference on the International Map in England during July, 1928, the sheets produced by the Society will be included on the index maps of standard sheets of the International Map issued by the Central Bureau. The Society has now published fourteen sheets of the map and ten others are in full color proof and are now being printed. Thirteen others are drawn and in the lithographer's hands and compilation and drawing is well advanced on a large number of others.

ROBT. S. PLATT.

Field Study of a Sugar District: Mariel, Cuba.

The Mariel district is a unit of production in the Cuban sugar industry. The area of the district is sixty-five square miles, of which about 38 per cent is occupied by sugar cane. There is considerable variety in slope, soil, and drainage, and the distribution of cane has obvious relations to land surface features.

This geographic fact is a preliminary to the larger and more complex geographic fact that the distribution of land control, transportation, and the whole human organization of the district forms an intricate pattern of land occupancy—a pattern not determined by the natural environment but belonging definitely in its natural setting.

The pattern of land ownership is not perfectly adjusted, yet it has developed from natural arrangements in the past, modified to meet new requirements now—from circular Spanish grants a league in radius to sugar plantations with slave gangs and small mills, and now to a sugar district controlled by one central and divided among 225 *colonos* for cane production. Rural population is distributed over the district, providing labor needed in the cane fields.

The size of the district is related to the capacity of the central. The form and limits of the district are related to the transportation pattern. A railway system focusses on the central and reaches out to available cane lands. Cart roads focus on the various railway cane scales. The railway avoids the ascent to an upland area, but cart roads ascend the slope, and, by these, ox carts bring down cane from marginal parts of the upland. Thus the boundary of the district cuts across cane lands in the upland, a geographic boundary between areas which are similar in land forms, soils and climate, but different in location in a pattern of land occupancy.

The potency of location depends on movement. The pattern harmonizes with the natural setting not only in its motionless form but in its life and activity. The rhythm of the seasons is marked by the operations of planting, cultivating, and harvesting. The dry season is harvest time, for in the wet season sugar yield is low and transportation excessively difficult. The great effort of the year is the cutting and delivering of 160,000 tons of cane in a period of about a hundred days.

The central is located to receive this inflow from the fields and is elaborately designed to perform its function of extracting from the great mass of cane a relatively small amount of sugar, for shipment through the port of Mariel to the American market.

JEROME C. THOMAS (Introduced).

Type Studies in the City of Detroit.

Sections of the city of Detroit are widely varied in their landscape aspects. Specific blocks, scattered throughout the city are representative of these sections. The sections are (1) the commercial center, subdivided into the three types, the wholesale, secondary retail, and superior retail; (2) the inner transition, subdivided into the deteriorating exclusive and slums types; (3) the industrial; (4) the ordinary residential; (5) the exclusive residential; (6) the suburban; and (7) the outer transition. Representative blocks are described in terms of use, building types, relation of building area to land area, population nationality, population density, and general layout.

LEWIS F. THOMAS.

Geographic Aspects of Recent Plant Locations in Metropolitan St. Louis.

About five years ago a study of the localization of business activities in Metropolitan St. Louis revealed some trends and principles. During the last five years there have been many expansions of business plants at their present sites, many removals and expansions to new sites, and many new plants have located in this area. In all such constructions which involved a large outlay of money, careful studies were made. In each case some critical factor or factors had to be satisfied. Numerous illustrations of specific plant locations were presented to indicate different adjustments of different business types to particular plant sites. It has been gratifying to observe that such locations have been in line with the trends and principles set forth in the earlier study, as follows:

(1) One fact stands out prominently with regard to the localization of commercial activities, namely that in spite of the rise and fall of mercantile establishments, and in spite of the changing conditions of transportation, the Downtown St. Louis Section still includes the sites of the original wholesale houses.

(2) The commercial importance of St. Louis is further indicated by the development of manufacturing activities, which are a direct or indirect outgrowth of the wholesale and jobbing industries. Because of the intimate relationship, factories of this type are located in or as near as possible to it.

(3) The East Side Industrial Section has excellent facilities for assembling and distributing materials and products by means of the twenty railroads which focus there. Cheap coal in large quantities are available from the Illinois Coal Fields. Large quantities of water can be economically obtained from the Mississippi River and from shallow wells. Large areas of low priced land are available for building sites. Hence large heavy manufacturing concerns should locate in this section.

(4) An exception to the rule that heavy manufacturing plants using large quantities of coal are located on the East Side is afforded by the clay and cement industries of St. Louis. Although fuel is very important, the principle locative relationship is the supplies of basic raw materials, clay and limestone.

(5) The erection of a super-power plant in East St. Louis represents one of the exceptional cases in the long list of adjustments to the Mississippi River during the industrial and commercial development of Metropolitan St. Louis.

SOPHIA A. SAUCERMAN (Introduced).

Ports of International Concern.

The Convention on the International Régime of Maritime Ports was developed and adopted by the Organization for Communications and Transit of the League of Nations for the purpose of establishing in the ports of the nations adhering to the convention freedom of communication and equality of treatment as between States in matters of international trade.

This convention, in common with the other conventions on international transport drawn up by the Organization, was designed to form a uniform basis for agreement between States in order that development of preferential and discriminatory treatment might be curbed. In the period following the World War, the dislocation of frontiers, the erection of new national jurisdictions, the complete derangement of international transport, and the multiplication of trade restrictions made such a basis for agreement particularly desirable.

The purpose of the convention is well stated in Article 2 of the statute incorporated in it. Each of the nations adhering to the convention, according to this article, undertakes to "grant the vessels of every other contracting State equality of treatment with its own vessels, or those of any other State whatsoever, in the maritime ports situated under its sovereignty or authority, as regards freedom of access to the port, the use of the port, and the full enjoyment of the benefits as regards navigation and commercial operations which it affords to vessels, their cargoes, and passengers."

The principle of the freedom of the seas long had been established in international law. Special agreements had been entered into by European States as early as 1832 to secure equality of treatment on international rivers; in the peace treaties following the World War detailed provisions were evolved for the international regulation of the Rhine, the Danube, the Elbe, and the Niemen, and later, general conventions relating to the international region of waterways and railways were formulated by the Organization for Communications and Transit.

The Convention on the International Régime of Maritime Ports bridges the gap between the regulations which establish equality of treatment for ocean and inland transport by establishing similar equality of treatment in the ports, which physically link transport on sea and land.

The principal significance of the convention from a geographic point of view is that adherence to its provisions serve to minimize the influence of artificial restrictions and to give increased force to basic economic factors in international trade.

R. H. SARGENT.

Notes on Certain Geographic Features of Alaska.

For approximately thirty years exploration has been carried forward in Alaska by the members of the Alaskan Branch of the U. S. Geological Survey. During this time many salient geographic features have been discovered and mapped, thus constantly adding to the map of the territory. The paper called attention to several of these features, describing in general the facts which were incidental to their discovery and recording and illustrating the features themselves by lantern slides.

ELLEN C. SEMPLE.

Irrigation and Land Reclamation in Ancient Mediterranean Lands.

ELLEN CHURCHILL SEMPLE

Irrigation and Reclamation.

Irrigation developed at an early date in the Mediterranean lands, owing to the seasonal distribution of the rains and the marked variability in the annual precipitation. It was necessary for all quick-growing summer crops which required abundant heat and moisture, and it supplemented the rainfall for the winter crops in years of deficiency. Irrigation was bound up with reclamation enterprises designed to increase the arable area in a region where prevailing mountain relief greatly restricted the proportion of tillable land. Hence it pushed forward the line of vegetation into the desert fringe; it attended the reclamation of wet lowlands or lacustrine basins by means of dykes and canals; and it became an adjunct of flood control as applied to swollen mountain torrents, in order to protect the scant supply of valley alluvium. Owing to relief conditions, large-scale reclamation was rare; but small-scale enterprises were numerous, wide-spread, and in many cases content with the acquisition of five or six square miles for a whole city-state.

While climatic conditions made irrigation advisable, the prevailing mountain relief made it feasible by maintaining perennial streams wherever exposure and elevation were favorable. Control and apportionment of the available water supply became an important function of government, and led to the development of an elaborate system of water-rights, which became apparent in early Grecian law and were finally formulated in the *Pandects* of Justinian. These laws reveal a close adjustment to conditions of climate and relief.

J. RUSSELL SMITH.

The Monsoon Rain an Economic Terror to Mankind.

Rain seems to result in most cases from an area of low barometer. In United States, Canada, and western Europe the areas of low barometer are of small extent and move rather rapidly as parts of a seemingly endless procession of high and lows.

This gives to such areas many rains per year, and (a) the risk of crop failures of famine proportions is reduced because of the law of averages; and (b) the famine area is of small extent because of the size of the rain producing unit.

In the large land masses that are situated in such a way as to develop monsoons we have a tendency to stationary lows and highs that hold their positions for many weeks in their respective seasons.

Thus Eastern Asia may be said to have *one* rain making low barometer area per summer. Therefore, the crop season depends on *one* area of low barometer which is of great extent. Therefore, it would seem that (a) its areas of crop failure of famine proportions should be of greater frequency because the rain is not dependent upon many lows to distribute the risk.

(b) The famine area should be of large extent because the rain unit is of large extent.

This thesis was advanced tentatively in the hope that the members would come prepared to discuss it.

HELEN M. STRONG.

Geography in Business.

The geographer sees a world picture and has a unique equipment, vision and technique, which is of practical value when applied to business problems. The geographer of the Bureau of Foreign and Domestic Commerce has been using this technical geographic equipment in the services rendered day by day to business men, and these services indicate some of the ways in which scientific geography may function in the solution of business problems. These experiences reveal a significant opportunity awaiting the geographer in more than one great business enterprise, and have proved the importance of geography in the practical working equipment of business men and women.

A geographer may bring to statistical and unattached discussion a background of rich relations which make for intelligent and strategic planning in small or large business enterprises. The geographer gives a concrete background to every business problem. One manufacturer requires the exact beginning and end of seasons throughout the world, so as to work out a distribution which will create a level demand for his goods throughout the year. Another needs to know soils, another the complete environment of a region and its tributary areas. The geographer, by dealing with definite,

concrete facts and relations in the environment, affords business the same specific information in this field as financial statistics present for other phases of his problems.

Only the professional geographer can provide business with this working equipment, for he alone knows how to obtain, assemble, correlate, interpret, and apply scientific geographic material. As large business enterprises become familiar with the value to them of this geographic contribution, they will employ geographic advisers and seek people with geographic training when they add to their staffs. These geographically trained men and women will enable American business to plan its campaigns with an actual world picture in mind, visualizing definitely the lands into which their salesmen and goods are going. They will guide American enterprise with scientific statesmanship at home and in every part of the globe.

GLENN T. TREWARTHA.

The Suwa Basin: A Geographic Study in the Japanese Alps.

The Suwa Basin, in the heart of the mountain knot which forms the central core of Honshiu, exhibits within a restricted area landscapes, both natural and of human impress, which are characteristic and typical of Japan's most specialized silk producing region.

As the Japanese Archipelago is the focus of raw silk production for the world, and Nagano Prefecture, a mountainous landlocked political subdivision, in turn, is the most specialized general region of sericulture within Japan, so the Suwa Valley in Nagano, an alluvial filled graben ten miles long by three and one-half wide, represents the most definite center of raw silk reeling within the country. High and rugged mountain ramparts, whose lower foothills only are cultivated, girdle it on all sides, so that the trans-island railroad gains entrance and makes exit only by means of tunnels. The lowest part of this high altitude basin, nearly 2500 feet above sea level, is occupied by a shallow lake six to eight miles in extent. On the northwest a steeply inclined delta-fan, under intensive cultivation in mulberry and rice, is encroaching upon the lake margins, while to the southeast, a larger delta of much milder gradient, and more exclusively devoted to rice, is making similar trespass. Numerous small rural villages dot both alluvial areas and occupy sites along the foothill margins, while several industrial

urban communities, specialized in filature, the largest a city of 40,000 people, have developed on the northern fan.

Contrasts of first magnitude lead to a differentiation of two major geographic units: (1) the encircling mountain foothills and, (2) the basin floor. The latter by reason of morphologic contrasts of lesser magnitude is further subdivided into three geographic sub units: (1) the lake, (2) the southeastern delta-fan, and (3) the northwest delta-fan.

S. VAN VALKENBURG (Introduced).

A Physiographic Study of the Rhone-Rhine Depression in the Swiss Alps.

The present relief of the Alps is not due to one cycle of erosion. Careful study of the preglacial deposits in the northern Alpine Vorland and their continuation into the Alps brought a probability that the preglacial relief of the Alps was a mature one with wide valleys and rounded divides: as a whole independent from geologic structure or composition. The average elevation of the preglacial divide will have been about 5,000 feet. During three summers field work all through the Swiss Alps, it was possible for me to reconstruct that preglacial surface because parts of it were saved from erosion by the covering stationary ice sheet. The huge amount of glacial erosion consisted principally in widening and deepening the existing depressions and the original surface was often kept nearly intact till it was entirely dissected by glaciers. That explains the surprisingly equal elevation of round mountains, like the Monte Rosa, and the surrounding peaks like the Matterhorn.

This preglacial surface does show in its present position not only an enormous uplift of sometimes more than 10,000 ft. but also a bending with two anticlines and a rather narrow syncline between. This longitudinal syncline was the base of the present Rhone-Rhine system which is also not entirely a product of erosion but was pre-disposed by structure. It was possible to trace its continuation to the French Alps till near the Mediterranean Sea. The Swiss part of the depression is now occupied by three rivers, each with an outlet perpendicular to the longitudinal valley: (1) the Rhone with an outlet to the Lake of Geneva; (2) the Reuss with the outlet to the Lake of Lucerne; (3) and the Rhine with the outlets to the Lake of Constanx and the Lake of Zürich. Low passes between these three river systems (the Furka and Ober Alp Pass), show the

original unit of the depression. The outlets may be considered as antecedent, as relics of the preglacial drainage; two of them follow preglacial structure features (synclines), and even some of the present well known north-south Alpine passes like the Grimsel may present former valleys from the time that the main divide was farther south. In the depression itself with its typical glacial features as hanging side valleys, rest mountains, and post-glacial land slides, terraces represent the different glacial periods, and not principally the different stages of the last ice age as was indicated originally by Penck and Brückner. Alpine pictures are very useful to show the different results of the investigation.

O. D. VON ENGELN.

Forms of Waterfalls and Gorges.

In the type of waterfall resulting from the presence of a horizontal, resistant cap rock specific variations develop in the form of the fall and of the associated gorge because of differences (a) in the volume of water passing over the crest; (b) volume variations; (c) height of the fall; (d) details of structure: Otherwise stated, the variations in form are expressive of the rate of crest recession in relation to the rate and nature of the weathering processes operative. Significant types are (1) those exhibiting a long gorge, with perpendicular walls, terminated at a falls having a water-occupied crest-line extending the full width of the gorge; (2) those exhibiting a long gorge, with steeply sloping sides, terminated at a falls with a crest-line much narrower than the gorge below (2) with an overhanging crest, (b) with no overhangs of the cap rock; (3) those in which the valley below and above the falls has much the same form in cross section. Such forms are illustrated by specific examples. These principles may be used for interpretation of certain valley occurrences.

WALTER H. VOSKUIL (Introduced).

Potential Sources of Potash.

The post-war Franco-German potash agreement covering the world markets again brings to the attention of American consumers the difficulties of dependence upon a foreign monopoly. The possibilities of developing competitive sources, therefore, is of considerable interest. A survey of world resources shows the existence

of an abundance of potash-bearing materials or deposits in the United States, Spain, Italy, Poland, Eritrea, and lesser or less known deposits in Russia, the Netherlands, the Dead Sea, Canada, and Chile.

The exploitation of Spanish and Polish potash bearing salts and the recovery of potash from leucitic lavas in Italy has reached the commercial stage. The recovery of potash from the nitrate deposits of Chile is accomplished by the Dupont Nitrate Company, whose plant has a productive capacity of 10,000 tons of 25 per cent potassium nitrate. The commercial extraction of potash and other salts from the Dead Sea is receiving serious consideration. Concessions for such recovery have recently been granted to a British syndicate.

In the United States, the most promising source of potash exists in the salt beds of Texas and New Mexico, although other sources, notably the natural brines of California and Nebraska, Utah alunite, Wyoming leucite, New Jersey greensands cement mill and blast furnace dusts, offer possibilities. Each of these raw materials constitute a distinct problem. The production of cheap potash will come about, not by the exploitation of a single large deposit, but by the erection of relatively small potash plants, located with reference to the agricultural areas to be served, and turning the by-products into marketable commodities. Only in this way can we hope to effect complete emancipation from the Franco-German monopoly.

R. H. WHITBECK. (To be published in June Annals.)

The Chileans and Their Geographic Environment.

The shape of Chile, its greatly accentuated climatic and topographic features, its boundaries, location, and mineral wealth, its strong government and aggressive people, all combine to make it a country of no commonplace character. Endowed with water-power and with coal, iron, copper, and a considerable list of other minerals, and with many raw materials, it may justly aspire to be the supplier of manufactures for a part of South America.

The great landed estates and powerful landed aristocracy, the dependence of the country upon nitrate revenues and foreign investments, the limited agricultural area, and the small population, constitute national problems of real seriousness.

ALFRED G. WHITE (Introduced).

The Diversification of Industry in Brazil.

Brazil is the largest country of South America in area and population. Her economic activity has been highly specialized; even at present, coffee represents about 70 per cent of the value of her exports. Such a degree of specialization gives rise to serious economic and financial problems. The country has a great variety of climates and resources. It is capable of much greater diversification and the beginning of progress is already clearly in evidence. The rapidity with which such changes will take place depends on the condition of the world demand and on the ability of Brazil to organize production efficiently along new lines.

In the report the problem was discussed under four main headings. The first section indicated the present problem of overspecialization and gave a brief review of the economic history of the country which had led up to it. The second section indicates Brazil's ability to develop more varied industries. The third section discussed in detail the principal lines in which diversification is taking place. The fourth section gave a summary of the conclusions reached and of the economic and political significance of the changes which are taking place.

No nation of Latin America is geographically so well situated to develop a diversity of products as is Brazil. It has vast fertile areas suitable to both tropical and temperate products. The most significant lines of expansion in which progress is being made as emphasized in this report are:

- (1) The improvement of live stock and the expansion of the export of meat.
- (2) An increase in the production and export of raw cotton.
- (3) The growth of textile and other local industries to supply the home market.
- (4) The export of iron ore and the establishment of a domestic steel industry.
- (5) An expansion in wheat production for home consumption.

These lines of diversification and expansion are all most closely allied to the semi-tropical plateau of Central Brazil or to the mild climate of South Brazil. These regions are suitable for white population, especially of the south European type. An adequate labor supply suitable to the development of the industries discussed will

be available from immigrants and from the rapidly increasing native population.

In the main, the lines of diversification suggested are economically sound, for a country which is still predominantly in the agricultural state, with abundant land and resources capable of more intensive development. The production of meat, the growing of raw cotton, the mining of iron ore, the raising of wheat, are all closely related to favorable natural conditions and to products in growing demand throughout the world. The encouragement of manufacturing based on a high protective tariff, such as the textile industry, is the line open to most question. It seems that, outside of purely local supply industries or those necessary to the preparation of raw products, Brazil should proceed slowly in manufacturing development and devote her attention to the products of a country still in the agricultural stage.

LANGDON WHITE (Introduced).

The Iron and Steel Industry of Cleveland, Ohio.

If it is assumed that the three major factors, which influence the general location of an iron and steel industry, are accessibility to markets and to iron ore and coaking coal, then Cleveland should be given credit for having the most strategic location in the North, for it assembles its basic raw materials more economically than any district depending upon Lake Superior ore and, next to Chicago, is the country's most evenly balanced district from the standpoint of production and consumption. Moreover, it enjoys the advantage of a relatively early start, which has made the steel industry a "fixed" one. Because of these several significant advantages, it might justly be assumed that Cleveland would surpass its rivals in the production of steel ingots. Yet figures indicate that it ranks not first but fifth—being surpassed by Pittsburgh, Chicago, Youngstown, and Philadelphia.

It is thus evident that Cleveland labors under some disadvantages, not relative to general location but rather to specific plant sites, else it would outrank competitive districts in production. Undoubtedly its most serious handicap is its dearth of cheap flat land for new industries and for expansion of established ones. The limited industrial area—some 4,300 acres—in the river harbor is utilized fully. No more land can be procured except by straight-

ening the Cuyahoga, which would add 2,600 acres in the upper valley.

Another deficiency is the river's tortuous course, which prevents the largest boats from reaching the majority of furnaces. This is acute indeed, since larger boats are being constructed in order to effect greater economies. In 1924 less than one-third of the lake freighters could navigate the abrupt bends and the narrow channel of the lower river and the proportion has decreased since then.

Cleveland's future as an iron and steel center is assured; its industry will grow steadily though not sensationally—a condition which is to characterize all major districts; never again will any one place wield the scepter as did Pittsburgh for several decades. America's iron and steel industry has become decentralized for all time.

Probably Pittsburgh and Chicago will retain first and second places, but Cleveland may seize third place from Youngstown, which *now* is fighting a great industrial battle against the odds of an unfavorable geographical location.

DERWENT WHITTLESEY.

A Schema for Studying the Agricultural Occupance of the Land.

The utter variance in both content and method of existing works on agricultural geography render them almost useless for comparative quantitative study and suggest the desirability of uniform basis of approach which geographers can agree to and a topical schema of classification which they can adhere to.

A useful approach seems to be the analysis of each agricultural set-up in terms of its inherent characteristics or traits, regardless for the moment of both causes and consequences.

A classification schema, arrived at empirically, includes four major heads: (1) the crop, pasture, and livestock association, i.e., what is found on the land; (2) methods of production; (3) return; (4) disposal of products. The subheads under these categories provide for both statistical items and statements not susceptible of statistical treatment; they take account of absolute values, quantities, and numbers, and also of ratios between these items; they all possess areal flavor, in that they call for descriptive, distributive, locative, or comparative facts; and they include both items which can be seen with the physical eye (i.e., landscape features

in the narrow sense), and statements of the partially visible landscape brought into clear light by the aid of compiled information.

Some of the utilities of this schema appear to be: (1) a simplified and defined analysis which excludes items not useful in chorologic study and discloses gaps in information, in addition to providing a frame into which available data may be coherently fitted; (2) facilitation of presentation in relation to causes and consequences, i.e., as geography; (3) ease in dovetailing work done independently, and so hastening the day when quantitative information about the whole world will be in hand.

It is assumed that a schema on the same plan (inherent traits) can be worked out for every cultural aspect of geography, as has already been done for the elements of the natural environment. This paper is confined to agricultural occupancy of the land.

FRANK E. WILLIAMS.

Some Effects of Culm in the Schuylkill River.

The early part of the nineteenth century marks the inception of anthracite as an important fuel. The fields in the upper portion of the Schuylkill Valley were early developed. As soon as active mining was carried on culm began to appear in the upper tributaries of the river.

The culm which is found in the stream has its origin in the discharge from collieries which are preparing freshly mined coal; in the washeries which are working over old culm banks; and in the erosion of the existing culm piles.

The presence of this material has changed physical conditions in the bed of the river and has affected man in several ways. Navigation on the Schuylkill River and on the Schuylkill Canal has been greatly handicapped by culm deposits. A channel has been maintained with much difficulty due in large measure to this material. All the towns and cities along the river, except Reading, are dependent on the Schuylkill for their water supply. The presence of culm has caused much expense in sedimentation, filtration, and cleaning of intakes. In a similar manner manufacturing plants have been handicapped in getting water for industrial purposes. Of less interest but of local importance has been the effect of the culm on minor floods and freshets, on small areas of agricultural lands, on the fishing industry, on recreation, and on development of water power.

While the finer particles of culm in suspension discolor the water of the Schuylkill River in all parts the detrimental effects of the deposits are just beginning to be felt in the lower section of the river near the city of Philadelphia. The first effects of these deposits were noticed about 1870 near Port Carbon at the upper end of the canal. With each high water or flood stage this culm is carried farther down stream while material is continuously added in the upper waters. Thus there is a progressive movement of large amounts of culm down the river with accompanying deposition in the channel.

There remains the navigable tidal portion of the river that is scarcely affected. It is probable, however, that it will be but a short time until the culm will present a navigation problem within the city of Philadelphia.

LOUIS A. WOLFANGER (Introduced).

"The Influence of Climate as a Factor in Soil Evolution as Illustrated by the Loessial Soils of the United States."

One of the fundamental tenets of the philosophy of modern soil science is the principle that climatic forces constitute the most dominant soil-forming agencies. Their influence on the fundamental characteristics of normal soils exceeds even that of the parent material.

The truth of this generalization may be demonstrated in two ways. Comparative studies can be made either of soils derived from like parent materials under different climatic conditions or of soils derived from unlike parent materials under the same climatic forces.

The former method is employed in this paper, an appropriate illustration being furnished by the well known loess or loess-like deposits of the United States. These formations occur under climatic condition extending from the humid sub-tropics along the lower Mississippi to the arid Snake River Plains of southern Idaho. Type soils are selected from each important climatic belt included.

In-so-far as chemical data are available, the normal loessial soils develop under an approximate average rainfall of more than thirty inches annually (the effective amount varying with latitude) appear as a whole to be more or less acid in reaction and in general have a higher proportion of iron and alumina in the subsoil than in the surface horizons or parent material. Those developed

under an approximate average annual rainfall of less than thirty inches are more or less alkaline in reaction and have a higher proportion of calcium carbonate in the subsoil.

Differences in rainfall above the limit named, as well as in temperature, have brought about additional dissimilarities among the iron-alumina group. The high rainfall and temperatures under which the loess deposits of the lower Mississippi occur has given rise to soils more thoroughly leached, lighter in color and lower in organic matter, than those in eastern Iowa where the average temperature is not as high and rainfall is less.

The gradually diminishing rainfall under which the loessial formations extending from eastern Nebraska to southern Idaho occur has produced several important sub-groups among the calcium-carbonate division. The dark colored, almost black, comparatively unleached, and finely granular loessial soils of southern central Nebraska and the adjacent parts of Kansas have formed under sub-humid conditions. The semi-arid climate of western Kansas and Nebraska have developed chestnut colored soils with a coarser, cloddier structure. The very light grayish brown loessial soils of southern Idaho have evolved typical desert characteristics under the influence of aridity.

Natural vegetation varies from deciduous forest to sagebrush. Other life responses have a similar range. It should be observed, however, that many of the relationships are functions of the soil as well as the climate. It is evident, moreover, that the widely used expression "rich loessial soils" is a phrase of limited significance.

JOHN K. WRIGHT.

The New England Studies of the American Geographical Society.

The American Geographical Society has embarked upon a series of studies of the population of New England in its geographical relations. The construction and interpretation of distribution maps for the whole and large parts of New England will be supplemented by intensive investigations of selected type areas. Stress will be laid upon tracing historical trends illustrating them cartographically, especially such trends as serve best to explain present day circumstances. Suggestions, criticism, and the contribution of papers on the geographical aspects of their specialties will be

sought from experts in New England's agriculture, land utilization, history, sociology, and economics, and from men of affairs. Some of the results of the studies will be published in the *Geographical Review* and ultimately the fruits of the program of research as a whole will be issued in one or more bound volumes.

SPECIAL PAPERS

CHARLES C. COLBY.

*Twenty-five Years of the Association of American Geographers: A Secretarial Review.**

This review was planned by the Council as a feature of the dinner celebrating the twenty-fifth anniversary of the founding of the Association. It was based on a study of the minutes of the Council meetings and the scrap books which have been kept throughout the life of the organization. The purpose was not so much an historical sketch as a summary of the outstanding activi-

YEAR	TOTAL PAPERS	FROM MEMBERS	FROM NON-MEMBERS
1904.....	20	15	5
1905.....	37	30	7
1906.....	42	35	7
1907.....	45	32	13
1908.....	38	31	7
1909.....	31	25	6
1910.....	34	24	10
1911.....	45	38	7
1912.....	21	17	4
1913.....	34	26	8
1914.....	39	28	11
1915.....	28	28	0
1916.....	31	19	12
1917.....
1918.....	35	32	3
1919.....	25	15	10
1920.....	37	29	8
1921.....	30	23	7
1922.....	23	19	4
1923.....	31	24	7
1924.....	41	33	8
1925.....	31	18	13
1926.....	26	16	10
1927.....	44	23	21
1928.....	51	34	17
	<hr/> 819	<hr/> 614	<hr/> 205

*Read at the New York Meeting, Dec. 27, 28, and 29, 1928.

ties of the Association. The review shows that during the first quarter century of its existence the Association has emphasized two functions, namely, its annual meetings and the publication of its *Annals*.

The annual meetings of the Association have been devoted to the presentation and discussion of papers by members and by introduced or invited speakers. A meeting has been held in every year except the war year, 1917. As shown in the accompanying table, the programs of the annual meetings have carried a total of 819 titles, 614 from members, and 205 from non-members.

PAPERS PRESENTED BEFORE THE ASSOCIATION

In addition there were presented each year the addresses of the retiring presidents, and in most years a round table discussion has been featured. During the period from 1914 to 1922, inclusive, six spring meetings were held in coöperation with the American Geographical Society. The experience in program making gained by the Association during this first quarter century of existence has made it the acknowledged North American agency for the preparation and presentation of programs in scientific geography.

For five years after it was founded, the Association did not attempt to publish any of the papers presented at the annual meetings. Abstracts of papers, however, appeared in the preliminary programs beginning with the second annual meeting. In 1911 the Association published the first volume of its *Annals* and, since that time, has continued this publication without interruption. From 1914 to 1922, inclusive, the *Annals* were published under a coöperative arrangement with the American Geographical Society. Under this arrangement "All editing, proof reading, managing subscriptions and collecting for the same (the *Annals*) to be done by the Association. The expense of manufacturing to be paid by the Society." The financial aid assured by this arrangement meant that the editor and Council could devote their attention to the contents rather than the finances of the new publication. As a result, the *Annals* not only attained a fine beauty of page and dignity of form, but became a rich source of geographical materials, ideas, and philosophy. The arrangement with the American Geographical Society was terminated in 1922 and the "Joint Research Fund" built up by the two organizations was turned over to the Association with the understanding that the income from the fund was to be used in financing the *Annals*.

The founders of the Association placed great stress on the importance of restricting the membership to those who have done original work in some phase of the science of geography. The minutes of the Council meetings and the records of the votes of the membership disclose the fact that the high standard of the founders has not been changed or modified. This and other phases of the life of the Association show that throughout its existence the Association has had but one central interest, namely, participation in and promotion of the science of geography.

ALBERT PERRY BRIGHAM.

An Appreciation of William Morris Davis. Read at the New York Meeting, Dec. 27, 28, and 29, 1928.

Hoping to speak to Professor Davis, I find to my regret that I may only speak about him. Many years ago I wrote at some length of his career, but a score of years of achievement have passed since that time. "One of the blessings of old age," it has been said, "is that money will buy most of the things it wants." This is not true of our friend, to whom progress is the prime need. He has the eager mind and, in a high sense, wants the earth. "He doth stride the narrow world"—may be said of him.

He devoted himself to the studies of the atmosphere, and then he gave himself to the lands, not merely their evolution, but in good measure to a search of their regional parts. He was in South America when Mr. Hoover was an infant; in Europe he has studied in book and field, and represented American geography there. Asia, Africa, and Australia have called him and he might have said his *Nunc Dimittis*, but no—with Horace he must "grasp the ocean with his span." Now after years of corals and salt water, give him time, and he will go after the "asthenoliths" and make his own the polar lands and waters.

Almost forty years ago I met him, in 1889, and from him gained this lesson, not in his words but in his spirit and example—*Find it out for yourself, and, find it all out.* There was not then a working department of geography in any American university. Of what has grown since he might say—"I saw, and a part of which I was."

I will not dwell on the chronology of his career, his part in the Committee of Ten, his pioneer texts, his St. Louis address, his founding of this Association upon expert standards, his strong precept and example for a quarter of a century.

Enough is it for me to say, that he is the leader and senior in geographical research in America; and in the promotion of geographical study and interest.

He has made geomorphology a science to a degree not otherwise attained in America or in any other country, a result due to keen observation, clear logic, and marked graphic skill.

He has *taught the teacher* and led the investigators. For the proof, look around you tonight and go back in memory. He has been fruitful in projects and generous in putting them at the disposal of others.

He has encouraged and appreciated every phase of geography. He can write the so-called human geography, when he pleases, as witness his *United States*, in the International Geography. None more than he has welcomed to our circle men of all contributing sciences—Cleveland Abbe, H. C. Cowles, Charles C. Adams, F. J. Turner, Forest Shreve, and others. I do not think he worries about the center or the circumference of geography, a science which will find its own, and, if too aberrant, will be self corrective.

This Association grew out of physiography, or, shall we say, physiographers? Then we swung to human geography, and perhaps became too free with the phrase, geographic influence. Now we are coming back to symmetrical views and modest caution. The face of the earth and the distribution and adjustment of life are all geography. This is the most inappropriate time in all history to be concerned about the interfering or overlapping of any, or all of the sciences. Notwithstanding our prejudices and programs, geography in research and geography in education will take on what it wants, and slough off what it does not want.

We need concern ourselves with but one thing, each to do our part as Professor Davis has done his, to try with him to make this round world our own, and, into the appreciation of it, to help others to enter.

CHARLES C. COLBY.

Memorial of Charles Redway Dryer.

Charles Redway Dryer, a charter member of the Association of American Geographers and formerly a professor of geology and geography in the Indiana State Normal School at Terra Haute, died at his home in Fort Wayne, March 21, 1927. Professor Dryer was born in Victor, Ontario County, New York, on

August 31, 1850. He graduated from Hamilton College with the degree of bachelor of arts in 1871. Subsequently he studied medicine at the University of Michigan and in 1876 received the degree of Doctor of Medicine from the University of Buffalo. He practiced medicine for a short time and then turned to teaching. For more than a decade (1877-90) he taught biological and physical science in the high school at Fort Wayne, Indiana. During the latter part of this period he also offered courses in toxicology and chemistry in the then existing Fort Wayne College of Medicine, and from 1890 to 1893 was professor of toxicology and chemistry in that institution.

From 1886 to 1893 he served, during the summers, as an assistant on the Indiana State Geological Survey. During this time he surveyed the northeastern six counties of Indiana and worked out the glacial geology of that area. His geological work has had permanent value. Subsequent work in some areas has gone into more detail but in general Dryer's interpretations are not questioned. He was a Fellow of the Geological Society of America, where his contributions were welcomed and respected.

In 1893 Professor Dryer became professor of geology and geography at the State Normal School at Terre Haute and held that position until his retirement in 1913. During his two decades at Terre Haute he exerted a highly constructive influence on the teaching of geography in the schools of Indiana, and gained for his department an enviable reputation among the departments of geography in this country. In 1906 he taught physical geography at Cornell University and in 1908 and again in 1913 lectured in the school of geography at Oxford University. He was a Fellow of the Royal Geographical Society.

Professor Dryer was an enthusiastic participant in the organization of the Association of American Geographers and for nearly two decades was intimately associated with the affairs of the association. In 1914 he served as second vice-president, in 1918 as first vice-president, and in 1919 was president for the fifteenth annual meeting in St. Louis. The breadth of his geographic interests is shown by the titles of papers he offered on the programs of our Association. Among others these include "Some Features of Delta Formation," "Maumee-Wabash Waterway," "Philosophical Geography," "Natural Economic Regions," "The Calumet District," and his justly famous presidential address on "Genetic Geography." His papers invariably were highly original

in concept and organization and betrayed the scholarly character of his mind.

Professor Dryer was a writer of unusual clarity and force, with the gift of saying much in few words. Through his publications he made important contributions in the fields of physical, regional, and educational geography. Probably his most widely known publication is his *High School Geography* published in 1911. Both the number of his titles and the quality of his products show that he was a worker of unflagging zeal and enthusiasm. In an unusual degree Professor Dryer combined strong will with modesty, and deep conviction with liberality. He was a good listener and open-minded but his conclusions were his own, not those of another. His career may be epitomized under the triple characterization—stimulating teacher, eminent geographer, and cultured gentleman.

C. O. SAUER.

Memorial of Ruliff S. Holway.

Ruliff Stephen Holway died in Oakland, California, on December 2, 1927. He had become Professor Emeritus four years previously. A period of uncertain health had been followed by marked improvement, so that we expected many contented years for him with his friends, his garden and his studies. In less than two years, however, he suffered a stroke, signalling the beginning of his dissolution, to which his body offered lengthy, but finally unavailing resistance.

Born of Quaker ancestry on a farm near Hesper, Iowa, on May 8, 1857, he became a country school teacher in that state and later an instructor in science in high school. In 1884 he was made principal of a California High School, occupying a similar position in San Jose in 1887. This led to appointment as teacher of physical geography at the San Jose Normal School, where he also served later as Vice-President. Here he had the opportunity of completing his college course at Stanford University near by, receiving the bachelor's degree in 1903. In that year he removed to the University of California as Instructor in Education and took his Master's degree the year following. In 1904 he was appointed Assistant Professor of Physical Geography, in 1914 Associate Professor, in 1919 Professor, and retired in 1923.

This bare outline of his career records the quiet steadfastness of purpose, the essential stability of character that marked his nature. His opportunity to enter the academic field came late in life, and he was fully conscious of the difficult task of reorientation that he set for himself in making the change. Always he invested the instruction of youth with a sincerity and devotion that bound to him loyally his pupils, many of whom are now teaching in all parts of the state. Moderate in opinion, punctilious in workmanship, and sane in judgment, he prepared a sound basis for the development of physical geography on the western coast. During his most active period he led the California Physical Geography Club, composed principally of his students, which attracted considerable attention to studies of the physical features of the state. He contributed about two dozen articles to our literature, of which the best remembered are his studies of the Cold Water Belt along the West Coast, the Extension of the Known Area of Pleistocene Glaciation to the Coast Ranges, the stream history of the Russian River, the Unfinished entrance to San Francisco Bay, and a series of studies on the Volcanic Activity of Lassen Peak.

His was a gentle spirit, avoiding contention and the paths of ambition. Forbearance, kindliness, and extreme modesty determined his unobtrusive course through life. He lived truly in the light of the humane creed that nurtured him and he gave the full measure of his strength to his chosen field.



